Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. L. NEW YORK, SATURDAY, JULY 13, 1907. No. 2.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. McGRAW, Pres.; CURTIS E. WHITTLESEY, Sec. and Treas.

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
SAN FRANCISCO OFFICE.....601 Atlas Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada..... 4.50
Other Foreign Countries within the Postal Union..... 6.00
25 shillings. 25 marks. 31 francs.

Foreign subscriptions may be sent to our European office.
Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to July, 1905, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Copyright, 1907, by McGRAW PUBLISHING CO.

Entered as second-class matter at the post office at New York, N. Y.

During 1906 ELECTRICAL WORLD *printed and circulated* 970,000 *copies, an average of* 18,827 *copies per week. Of this issue* 16,500 *copies are printed.*

NEW YORK, SATURDAY, JULY 13, 1907.

CONTENTS.

Editorial 73
The Municipal Ownership Inquiry..... 76
Electrical Display for Boston Old-Home Week..... 77
Engineering Education 77
Valve for Vacuum Tube Lamp..... 79
Invention of the Telephone..... 79
Current News and Notes..... 80
The New Building of the Boston Edison Company..... 83
Arc Lamps for Railway Car Illumination, Their Distribution and Characteristics. By Alfred L. Eustice..... 88
Niagara Meeting of the A. I. E. E..... 90
The Use of Special Instruments in Telephone Service..... 93
New Telephone Patents..... 94
LETTER TO THE EDITORS:
Wireless Transmission of Energy. By J. Hansen Boyden..... 95
Digest of Current Electrical Literature..... 96
Self-Starting, Single-Phase Motor..... 100
Dial Decade Testing Set..... 101
Exhibits at the Jamestown Exposition..... 101
Combination Telephone 102
Marshall Field & Company Adopt Nernst Lamps..... 102
Industrial and Commercial News..... 103
General News 105
Weekly Record of Electrical Patents..... 111

ELECTRICAL EXPORTS.

The electrical export trade has continued throughout the past year to exhibit many signs of healthy progress, and the returns now available for May indicate that the whole twelve-months will reach a high level. During May the exports of heavy electrical machinery were $800,566 as compared with $681,955 last year. For the 11 months, the total is $7,924,806 as compared with a previous $7,229,576 and $6,661,676 in 1905. In like manner the export of electrical instruments has shown a gratifying increase for the whole period, although May itself fell off somewhat. The exports of this class last May reached $619,393, while in 1906 they were $709,875. But for the 11 months they were $7,508,364 as compared with $6,-115,254 and $4,490,818 in the periods corresponding, of 1906 and 1905.

For the 11 months therefore the total export of electrical apparatus has attained the respectable figure of not less than $15,433,170, and it bids fair for the whole fiscal year to reach about $17,000,000. Large as this may seem, it is, however, below 10 per cent of the total production in this country of electrical goods, and from this point of view a good deal of effort can be put, and ought to be put, in the development of fuller trade relations with countries that are still in the list of "prospects." The United Kingdom, Mexico, British North America and Japan are our best customers for heavy machinery, and with them again, Brazil is a good patron of our electrical instruments. Under present tariff conditions there does not appear to be much to expect from growth of relationships with Continental Europe, but South America, the West Indies, Asia and the Far East are as open to us as to the rest of the manufacturing world; and there are huge, unsatisfied wants in all of them. Many of these countries without cheap fuel have fine water powers, and Mexico has shown how large a demand may be created by the latter. Recent years have seen also the production of large classes of detail apparatus for industrial and domestic use, which, serviceable in temperate climes, will eventually become indispensable in tropic and sub-tropic regions.

THE HEATING OF COPPER WIRES BY ELECTRIC CURRENTS.

Perhaps the simplest and most familiar fact connected with the flow of electric current through a wire is that the watt rate of generation of heat within any length of it is equal to the square of the amperes multiplied by the resistance of that length. This is a consequence of Ohm's law. When, however, we try to deduce from this fact the temperature elevation attained by the wire under the conditions of heat liberation, we encounter numerous difficulties, and the problem of either measuring or computing the increase of temperature becomes difficult. It is known that the temperature elevation of a concealed wire, cooled by conduction, follows a law similar to Ohm's law; that is, the temperature elevation of the wire corresponds to e. m. f., the flow of heat corresponds to the flow of electric current and the electric resistance is represented by a

thermal resistance, depending upon the dimensions of the insulating cover or covers, as well as on the thermal resistivity of the materials.

An interesting paper on the subject of concealed wires heated by electric currents, was presented by Dr. A. E. Kennelly and Mr. E. R. Shepard before the recent convention of the American Institute of Electrical Engineers. It was shown that the final temperature elevation of the wires increased faster than the square of the current in all cases. The measurements showed, in fact, that the temperature elevation for very small currents increased as the square of the current; but that at elevations near 50 deg. C. they increased at an exponent of about 2.2, or faster than the square, while at elevations near 100 deg. C. they increased at an exponent of about 2.3. The reason for this is that the hotter the wire becomes, the greater its resistance, and the greater the heat produced by a given current in that resistance. If the resistivity of copper did not increase with temperature, the final temperature elevation of the wire might be expected to increase in direct proportion to the square of the current strength. Within the range of 100 deg. C. temperature elevation, the plotting of final temperature against steady current followed nearly straight lines on logarithm paper. A large number of measurements were made on the heating of wires in sand, soil and gravel, from which a number of data on thermal resistivity of such substances have been tabulated for reference.

The Properties of Electrons.

It is a significant indication of the close connection between physical science and its applications, that President Samuel Sheldon's recent address before the American Institute of Electrical Engineers was devoted entirely to a subject of recent physical investigation—the properties of electrons. The paper is useful to the electrical engineer, because it forms a compilation of the most essential facts at present possessed concerning electrons, expressed in electrotechnical terms rather than in the language of physicists. The paper refers to the fact that the mass of an electron appears to be entirely electromagnetic. In other words, the only kind of inertia possessed by the ultimate particles of matter is their electromagnetic inertia, or the inertia of the self-induction of virtual electric currents, due to the motion of the electric charges which constitute electrons. When an electron is stationary with respect to its surrounding ether, the electric flux from its charge radiates uniformly in all directions and there is no magnetic flux developed. The stresses due to the radiating electric flux balance in all directions, or produce no resultant force upon the electron. When, however, the electron moves, the cutting of ether by the electric flux generates magnetic forces and these forces pull upon the electron. The distribution of electric flux emerging from the electron is also disturbed. It weakens ahead of the electron and intensifies in its wake. This causes a resultant electromagnetic force to pull back on the electron during acceleration, with an intensity proportional thereto, or in accordance with the Newtonian law of inertia. Work of an electromagnetic kind has, therefore, to be done upon any and every electron during acceleration, owing to its self-induction.

A mass of one pound is supposed to contain about 7×10^{29} electrons, or 7 followed by 29 zeros. The mechanical force of inertia of the pound weight, when moved suddenly, is supposed to be the total eletromagnetic force of inertia of that horde of electrons. The only difference between the electromagnetic inertia theory of matter based on electrons and the mechanical inertia theory of Newton, is that the mechanical theory takes it for granted that inertia is constant at all velocities, or is independent of velocity, so that a projectile should resist acceleration to the same extent, whether at rest, or already moving at a speed of half a mile per second; whereas the electromagnetic theory requires that the inertia of the projectile should increase with the speed, and become infinite at the speed of light. Practically, there is no discrepancy between these two theories within the limits of artificially producible speeds so far as experiment is likely to discover. In other words, the increase of inertia in a projectile fired from a large cannon would be quite insignificant, because its velocity is so small compared with that of light. The great potential importance of the electronic theory is not merely that it can explain inertia and the unity of all matter, but that it may in time lead to the comprehension of all chemical action. At present we know, for instance, that carbon and oxygen can combine with a disengagement of thermal energy, but we have no idea of why a carbon atom attracts oxygen atoms, how the combination occurs, or how heat is liberated in the process. Chemistry is mainly the name of a very long list of observed facts concerning the relative behavior of different substances, the ultimate nature of the substances and of their reactions being unknown. If, however, the electron theory can be highly developed, and if atoms of all kinds are mere groupings of electrons, we ought to get to understand how these different atoms must behave towards each other, and so, perhaps, predict chemical phenomena. Another great untility that may exist in the electron theory is in the working of metals in such a manner as to increase the number of free electrons, or the degree of freedom of such free electrons as ordinarily exist therein. By this means, we should expect to increase the electric conductivity of the metals, or diminish the size of wire that would be necessary for carrying a given power to a given distance with a given loss. Of course, it may be said that metallurgical experiments are more likely to be practically useful in this direction than electronic theory; but, on the other hand, it is readily conceivable that the electronic theory, if sufficiently developed, might suggest experiments that would otherwise never be thought of.

The Waste of Energy in Cables and Condensers.

In a cable carrying direct current, the loss of power which is wasted in heat occurs entirely in the conductor according to I^2R, so far as concerns practical operation, because unless the cable is seriously defective, the power wasted by current leaking through the dielectric is insignificant. With alternating-current transmission, however, the waste of power is not limited to the I^2R loss in the conductor, just as in direct-current cables, but includes also a loss in the insulator of the type E^2G, where G is an equivalent conductance of hysteresis, increasing with the length of the cable and with the frequency, but depending, as well, upon the nature and form of the dielectric. The virtual hysteretic conductance G of the cable is also affected by the wave shape of the impressed voltage. The extra loss of power in dielectric hysteresis is not only objectionable as waste of money at so much per kw-hour, but also

because it raises the temperature of the cable, and causes the safe carrying capacity of the cable to be reduced.

Our Viennese contemporary, *"Elektrotechnik und Maschinebau,"* has recently printed two articles of Dr. Bruno Monasch on the subject of this hysteretic loss of energy. A number of measurements were made of this loss in condensers and in short lengths of underground cable. The selected method employed a Wheatstone bridge balance, with resistance in the bridge arms, an optical telephone in the bridge wire, and a condenser with resistance in series to balance the test condenser. The bridge was supplied with alternating current of measured voltage. The observations recorded show that when the various samples of alternating-current power-transmission cables were tested at about 1200 volts and 50 cycles-per-second, the charging current had a phase of about 1 degree short of quadrature. This represents a distinct power-consumption component of current. The angle of quadrature defect did not vary much with voltage, or with frequency. The waste power which accompanies this one-degree phase-difference from quadrature may attain considerable proportions. For example, it is indicated in the article that a particular three-phase cable operating at 11 kilovolts and 50 cycles-per-second, might be expected to consume 580 watts per kilometer, or 930 watts per mile. In round numbers, this might be called a kilowatt per mile. In the course of a year, the total energy expended in an underground network of 60 miles in length of such high-tension cable, would be upwards of 500,000 kw-hours. It is evident that the economic importance of such dielectric losses in an extensive high-tension system may be serious, and call for careful study from engineers. Unlike I^2R losses, which increase with the load, and are relatively small during hours of light load, these E^2G losses are substantially the same all the year round.

THE SUSPENSION INSULATOR.

The Niagara papers of Messrs. Hewlett and Buck, the latter of which is printed elsewhere in abstract, present a most interesting and promising method of high-tension line construction. As Mr. Hewlett very properly intimates, the necessity of large dimensions has forced the ordinary pin form of insulator to a size that is both mechanically and electrically objectionable. It is mechanically bad in that the lateral strains are so severe that proper support is very difficult; and it is electrically bad because the large masses of porcelain required, even when the insulator is made in several parts, are difficult and expensive to construct of good quality. Moreover, by carrying the wires in suspension the strains on the long cross-arms needed in high-tension construction are greatly reduced. So long as wires were spaced only two or two and a half feet, the cross-arm gave little trouble, but the present practice of spacing five or six feet is quite another matter. The form of suspension insulators described is a very simple and workable one, being built up of units each of which is of a size easily made in a high grade porcelain. As is well known, the limit of voltage on insulators is due not to their capacity to resist puncture, but to their external sparking distance. By using several units in series this distance can be greatly increased and the puncture strength will always remain ample.

The advantages of such a construction are many and it ought thereby to be possible so to increase the sparking distance as very greatly to increase the working factor of safety. Even with the best pin insulators now obtainable the factor of safety is considerably less than prudence would dictate. Using four or five of these suspension elements in series, one should easily reach a factor of safety of four or five at all voltages now in use, and voltages now beyond the range of practice should become entirely feasible. That this construction is being tried on several important lines is most encouraging and it looks very much as though a safe basis had been secured for very considerable increases in working voltage. For the last few years transmission voltages have remained almost stationary. There has been a tendency upwards, shown by a moderate increase in the maximum used and by an increased number of plants working at from 50,000 to 60,000 volts, but the limitations imposed by the insulators have been very keenly felt. Now a new line of work is open and we shall be much surprised if it does not lead to a really considerable advance in voltage. The new insulators seem to be especially well suited to use with tower construction, since it is of course desirable to decrease the number of groups when each is somewhat large and costly, and the necessary length of a considerable series makes a high support especially desirable. The tower constructions shown by Mr. Buck are admirably adapted to their purpose and his promise of a 100,000-volt line is one that indicates a great advance in electrical power transmission.

There are still some structural considerations to be settled. The permissible length of span is determined by the weights to be carried, the proper securing of the lines against damage by swaying, and the most suitable frequency of anchorages, are things that must be worked out by experience. We note that in the 100,000-volt line described by Mr. Buck the spans are to be from 500 ft. to 1000 ft. This is a large difference and a comparison of costs and factors of safety for the two spacings would be most interesting. The question of proper spacing is particularly important in the case of aluminum cables with their very low elastic limit and relatively large catenary droop. The matter of anchorages is almost as important, since there must be no tendency for considerable lengths of line to work over. Fortunately mooring by these unit strain insulators is comparatively a simple matter, but it somewhat complicates the construction at the mooring towers. The very high present cost of conductors, however, fully justifies going to considerable expense to increase the working pressure, so that the suspension insulators come at a most opportune time. It is perhaps not to be expected that the new construction will disclose no difficulties. Considerable ingenuity may have to be exercised to protect the unit insulators against damage by the constant working of their wire connections, and the design of suitable fixtures may require considerable experimentation. Yet the broad principle is certainly an excellent one that promises much for the future of power transmission. The ability to work at 100,000 volts with a factor of safety greater than is now usual at 50,000 or 60,000 volts, implies a very large saving in conductors in all large transmission projects. For short-distance work at moderate pressures the suspension plan will hardly supersede the somewhat simpler pin construction save where heavy cables have to be carried. We shall await with the keenest interest the operation of lines insulated in the new way, and with considerable confidence in a successful outcome.

The Municipal Ownership Inquiry.

Some of the detail reports of the Municipal Ownership Commission of the National Civic Federation are beginning to make their appearance, through the newspapers, and the complete volumes are expected soon. The first two reports to come out deal with the relation between labor conditions and municipal ownership. One is written by Prof. John R. Commons, of the University of Wisconsin, and the other by J. W. Sullivan, editor of the *Clothing Trades Bulletin*, a union organ.

The views of Prof. Commons are in many ways favorable to public ownership, but he finds that the matter of dealing with employees is a serious problem. He favors the recognition of organized labor as a means of doing away with political pressure. Prof. Commons finds that in this country unskilled labor is better paid by municipalities than by private companies. In Great Britain, he says that, with municipal ownership hanging over them, private companies have been led to better the condition of their employees.

Mr. Sullivan goes extensively into the subject of municipal corruption in this country, and says that municipal ownership restricts men in their activities in a way foreign to American ideas, and has failed to promote the interests of employees under it. Mr. Sullivan says that only in the most poorly paid forms of labor has municipal ownership raised wages, and points out that it is antagonistic to organized labor. He says:

"Unionism and officeholding, even of the pettiest grade, do not fuse. Another source of undermining the union movement lies in such municipal benefit and pension schemes as have forestalled the unionization of both the Glasgow and Liverpool tramway forces. Inevitably purely trade-union organization will be discouraged with the progress of political trade-union organization. The national labor movement of Great Britain was perhaps necessarily changed in character for a time through the Taff Vale decision; a political demonstration was unavoidable, but the ensuing political events, despite voices of warning, carried the unions to a point difficult to distinguish from Socialism. And similarly, the steps beyond a union campaign for municipalization in this country and a stage of municipalization itself, should this come, cannot be foreseen by American unionists. There might indeed come a glimpse of the wonders of collectivism, but erected on the ruins of unionism.

"Appointments must be possible to all citizens. Union rules and orders must give way in the shop to the law and official decisions. The Miller case of the Government Printing Office at Washington set at rest reasonable doubt on these points, one result recently being the refusal of 70 members of the typographical union in that office to pay the union eight-hour assessment. In the municipal enterprises investigated at Richmond, South Norwalk, Syracuse, Allegheny, Wheeling, Detroit, Cleveland, and Chicago, the laborers are not organized, while in the mechanical trades both union and non-union men without discrimination hold positions. Through the activity of business agents union men may at some municipal plants obtain a larger proportion of situations than non-union, but rarely can the agent compel the municipal employee, if firmly unwilling, to pay his union dues."

Discussing the same subject, Prof. Commons, who is a well-known municipal ownership advocate, says with regard to conditions observed in England:

"The natural tendency of municipal employees to better their own condition by use of their political strength is seen in the growth of the Municipal Employees' Association. This is a spurious form of trade unionism which has sprung up with the growth of municipalization, and nothing of its kind has been found among American unions. It has gained affiliation with other unions in the Trades Union Congress and in local trades councils. Its platform is simple enough—to prohibit strikes, to oppose councillors at the polls if they stand in the way of granting its demands, and to call on other unions for help in the elections. Its demands are in excess of anything that other unions have been able to secure from private employers or even from municipal corporations.

"It invites into membership all employees of municipalities, and since they are nearly all eligible to other unions, evidently the aim of this organization is to separate a privileged class of workmen, and to do this through the political power of those whom they abandon. It weakens other unions while building on their support. With even a minimum of intelligence in the other unions, such a parasitic union would be repudiated. Such has been the fate of the Municipal Employees' Association. As long as its membership was small the consequences of its policy were not observed and its demands received the uncritical assent of others in the general approval of all efforts to raise wages. But with its rapid growth during the last two years the unions of unskilled workmen, who suffered first from its competition for members, brought their protest to the Trades Union Congress in 1906, and that body, after careful deliberation, repudiated the Municipal Employees' Association and all similar organizations of public employees by the, practically unanimous vote of 1,196,000 to 42,000.

"It is thus promptly settled, before this organization has reached 15,000 members throughout Great Britain, that the trade union world is clearly opposed, both in sentiment and self-interest, to the creation of a privileged class of municipal employees. As far as the regular trade unions are concerned the principle of trade union wages rising and falling in municipal employment is accepted in its full significance. Without the support of the regular unions the strength of the Municipal Employees' Association has disappeared. It was a temporary phase of the rapid increase of municipal ownership.

"The increase in municipal ownership in Great Britain has, of course, brought an increase in the number of municipal employees, and this has caused apprehension in certain quarters. Generally the chief officers of the municipal enterprise take the ground that they and other employees should not vote in municipal elections, and they openly set that example to their subordinates. Some of them go even so far as to advocate the disfranchisement of municipal employees in municipal elections. This has also been advocated by some of the councillors. However, such a proposition is no longer seriously considered. If the vote of municipal employees is a menace, the remedy must be looked for in directions other than disfranchisement. It goes without proof that such a remedy is needed, for municipal employees sooner or later cast their votes for candidates who promise or have secured a betterment of their condition, regardless of its effect on the enterprise as a whole. Omitting disfranchisement, there are two directions in which such a remedy can be found—first, a limit to be set beyond which municipalization shall not go, and, second, the attitude of the public, and especially of the workmen in private employment."

Mr. Sullivan, also, in support of his contention that municipal ownership has not bettered the condition of its employees, says: "Any advantages in wages or hours to be figured out for the municipal enterprises investigated in America over the private ones compared with them look like State illustrations of the soft berths to be found in public employment. To what extent the jobs are political for the employees, single or collectively, or a bid for the labor vote, is constantly a question.

"Public employees, frequently against their will, under duress from officials who may injure them, promote by election contributions the fortunes of certain men and parties, though at heart they may be opposed to both. The executive, mayor, councilman, or department head, not only in appointing, but in promoting or dismissing employees, is exposed to partisan, social, personal, or other pressure. Even if the reformer in office is genuine, even if the scheme he has promises well for the working masses, there arises the question of the duration of his official powers and those of his successors with similar aims, together with the assiduous attention of the public to its own protection."

Mr. Sullivan adds with regard to American conditions: "In America the municipalized enterprises visited by our labor in-

vestigators have been rich mines for significant facts relating to politics rather than to labor. These facts are not usually among those heretofore emphasized by the American advocates of municipal ownership. The testimony as to political rottenness, root and branch, in Syracuse, Allegheny and Wheeling is conclusive. The municipal plants examined in these cities, it is to be remembered, were selected as models by representative municipalizers of the commission. Nor is the political labor situation in Detroit, Cleveland, Chicago or Richmond at all settled as well as it might be. In Cleveland the present mayor in the beginning increased his reform forces in the public water department so as to strengthen his vote in the primaries—an act possible at all times also under the next and succeeding administrations, which may be bad where the present is good. The degree of purity attained by the present administration is attributable to the officials and the public sentiment aroused and not to municipalization. In Chicago, where civil service is ironclad, the appointment by the mayor of department heads and even of the Civil Service Commission itself has more than once proved a vulnerable point in the civic armor, with sad results. In Detroit, Cleveland or Chicago the stability of the municipally operated enterprises rests largely on the mayor, who, however personally estimable and statesmanlike, necessarily becomes as a candidate a relatively good or bad politician, representing for a brief term a policy that may change with his successor. It is plain that in this political situation the resultant labor problem is most difficult. An employee can only hold office in uncertainty, with its consequent evils. This form of disquiet is not usual in private employment. As at Richmond, its exclusion of black men suggests a burning race question indeed, North and South, were municipalization generally adopted and Richmond's example in that respect followed.

"Any advantage in wages or hours to be figured out for the municipal enterprises investigated in America over the private ones compared with them looks much like state illustrations of the soft berths to be found in public employment. To what extent the jobs are political for the employees, single or collectively, or a bid for a labor vote is constantly a question. A correct view takes in these points: Syracuse, the wages situation politically debauched; Wheeling, the same; Allegheny, the same, to an extent that when a difference of 50 to 100 per cent in favor of municipalization is soberly computed by one man it makes another laugh; Detroit, private and municipal plants but a shade difference; Cleveland, nine hours municipal against ten in the general labor market, wages the same; Chicago firemen in the fire department do not receive union rates; New Haven—no municipal undertaking—hours, eight, public departments, as against nine, water works; Philadelphia, United Gas Improvement Company, better wages and hours than any city department and a reduction from twelve hour shifts under municipal operation to eight under the company, with higher wages."

Electrical Display for Boston Old Home Week.

The electrical display during Boston's Old Home Week will be one of the chief features of the entertainment in the seven days between July 28 and August 3. An electrical parade at night which will be featured with a large number of specially decorated trolley car floats is planned by the committee which is headed by Mr. John Campbell, president of the Electrical Auditing Company. An electric fountain will be erected in the historic Frog Pond on Boston Common, and an electrical pyramid and electrical arch are also planned. Hundreds of strings of incandescent lamps will be looped through the public garden and common, and a special display will be made at the mall near the Charles Street entrance of these grounds. A floral electrical arch will probably be erected opposite the entrance of the South Terminal Station at the junction of Federal and Summer Streets. An electrical pyramid is also considered among the decorative schemes. C. Howard Walker, a landscape architect of wide reputation, has the artistic side of the decorations in hand, and Lt. Gen. Nelson A. Miles, U. S. A., retired, is in charge of all military features. Gen. Wm. A. Bancroft, president of the Boston Elevated Railway Company, is expected to serve as chief marshal of the civic parade, which has already booked over 10,000 participants.

Engineering Education.

The fifteenth annual meeting held last weeek in Cleveland by the Society for the Promotion of Engineering Education was well attended, more than 80 of the 415 members being present. During the meeting the council recommended 80 applicants for membership, thus bringing the total to 495. A large number of papers was presented dealing with every aspect of engineering education. Much credit for the success of the Cleveland meeting is due to Prof. W. T. Magruder, secretary, who also carried on the campaign which so largely increased the membership.

The new officers chosen are as follows: Charles S. Howe, president Case School of Applied Science, Cleveland; vice-presidents, Clarence A. Waldo, head professor of mathematics, Purdue University, Lafayette, Ind., and William G. Raymond, dean of College of Applied Science and professor of civil engineering, University of Iowa, Iowa City; secretary, Arthur L. Williston, director Department of Science and Technology, Pratt Institute, Brooklyn; treasurer, William O. Wiley, publisher scientific books, New York City.

A resolution was adopted asking the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Society for Chemical Industry each to appoint two members to act with three members of the Society for the Promotion of Engineering Education, as a committee on engineering education. The duties of this committee, as expressed in the resolution, will be to examine into all the branches of engineering education, including engineering research, graduate professional courses, undergraduate engineering instruction, and the proper relation of engineering schools to secondary industrial schools or workmen's schools, and to formulate a report or reports upon the appropriate scope of engineering educations and the degree of cooperation and unity that may be advantageously arranged between the various engineering schools. This joint committee is requested to make a report of progress to the society within a year and a final report within two years. Several of the other societies have expressed a willingness to take this action and it is believed that all of them will co-operate in the purposes for which the committee is appointed.

The address of President Dugald C. Jackson was on "The Relation of the Engineering Schools to the Secondary Industrial Schools," and very clearly represented his idea that the country needs more trade training schools in order to prepare its young men for the best work there is in them. There is need for more schools that turn out corporals and sergeants of industry, he said, and commended the farmers for their agricultural schools, but, at the same time, criticized them for their unwillingness to spend more money in that direction.

Secondary schools are inadequate in number and extent to meet the problem in secondary education. Those for training foremen and superintendents are almost unknown and little attention has yet been paid to making skilled artisans through schools of this kind. The speaker said that the organization of such schools lies with the teachers and faculties of the engineering schools and that they should make every effort to see that secondary schools are established and use their influence to foster them. The country needs trained artisans, men who are able to do their work intelligently and with a thorough knowledge of the process through which the material they are handling goes. Information in their line of work will lend interest to the operations of the shop and factory and make better men of the workmen.

Prof. H. H. Norris, of Cornell, presented a paper on "Meth-

ods of Studying Technical Literature," which was thoroughly interesting and led to considerable discussion. Profs. Harold B. Smith and Arthur W. French, of Worcester Polytechnic Institute, furnished a paper descriptive of the new electrical engineering building of that institution, while J. Walter Esterline, professor of electrical engineering, Purdue University, described the electrical engineering laboratory of Villanova College. Dayton C. Miller, professor of physics in Case School, followed with a paper on the Rockefeller Physical Laboratory of that institution. On the subject of "Organization and Conduct of an Electrical Engineering Laboratory," John W. Shuster, assistant professor of electrical engineering in the University of Wisconsin, furnished a paper in which he discussed the possibilities of an engineering school in laying broad foundations for future practice and the relation of practicing engineers to the school. A paper of Albert A. Radtke, professor of electrical engineering at Armour Institute of Technology, discussed plans of teaching central station work and making plans for plants. He said that students should be taught as far as possible from actual practice and observation of plants in operation.

A paper by Prof. Fred A. Fish devoted to the changes that have been made in the first two years of the electrical engineering course at Iowa City College led to a discussion on a five or six-year course of study in engineering schools instead of four, as most of them now have, and it was stated by some of the speakers that students would be much better prepared for their work, with more time spent in school. On the other hand, some of the instructors believed that but few would take such a course because of the time and the extra expenditure of money it would require. Again, it was argued that with the intensive study that is practiced in the German schools, American boys could do vastly more work than they do. The time should not be lengthened, one of the speakers said, but the students should be held to account for the work assigned to them. The German students work harder and the results are better. The answer to this was that boys could not be made into men instantly and that they would have to be borne with until they realize the purpose of an engineering education. It was brought out that a number of schools now have longer courses for those who desire them, and that a post-graduate degree is given to those who complete them. It was also suggested that a general engineering education be given in the four years, and that those who wished to spend more time specialize on what they wish to follow in the extra years they take.

Prof. Herman Schneider, of the University of Cincinnati, read a paper on the co-operative engineering course of that institution, described some time ago in these columns. Arrangements have been made with the Allis-Chalmers Company and some others of the large plants and factories in that city, through which students are employed every alternate week of the school year and given practical work, just the same as any of the other men. The classes are divided, so that when half the members are in the shops, the other half are taking the classroom work. While working, the men also take problems for the spare hours of the evening. In this way the men follow the work from the time the raw material is taken into the shops until the finished product is turned out. The course requires six years and the admission requirements are the same as for the four-year course. The plan has been in operation one year and good results are promised. Electrical, chemical and mechanical students are taking this practical work. They receive pay ranging a little higher than that of the ordinary apprentice and in all this amounts to something like $2,000 during the course. The members of the society were greatly interested in this paper and many questions were asked regarding the work, all of which the speaker endeavored to answer.

Mr. Charles S. Gingrich, of the Cincinnati Milling Machine Company, spoke on the same topic from the standpoint of the engineer or owner. He said that the factories must look to the engineering schools for their trained young men, but at the same time these men to be immediately valuable must be practical. In no other way can they gain a practical knowledge of actual manufacturing so well as working in the shop under shop conditions. They learn how to deal with the men and how to treat them, as well as gain an intimate knowledge of the work they will superintend later on. This plan takes the school into the shop instead of trying to take the shop into the school and that is the proper thing to do. The attitude of Cincinnati manufacturers is favorable to the plan.

A discussion of this paper brought out the fact that some of the railroads are establishing training schools for their men. The one at Altoona, established by the Pennsylvania Railroad, was mentioned, and the plan of large concerns doing this was discussed in a favorable way. As to trouble in Cincinnati from the labor unions, it was pointed out that the arrangements are with open shops, but that unions would not oppose the plan, since the men are not apprentices in the same sense that boys who expect to follow those vocations regularly are.

The report of the committee on industrial education, read by C. M. Woodward, Washington University, St. Louis, considered two kinds of industrial training—one that fits the boy mentally and morally for the work he is to do, and the other, that which the shop-school gives. The report stated that the difference between industrial training in Europe and this country is that the European method is to begin at the bottom, while in America the idea is to begin at the top. However, few industrially trained men in Europe ever rise to the dignity of engineers. They are trained to do their work, but little attention is paid to their mental training. Manual training schools in America are great feeders of the engineering schools, and should, therefore, be encouraged in every way possible. This country has comparatively few such schools in proportion to its population, and until more interest is taken in the matter, the European method will have to be considered the best. It can be used to good advantage in America in a modified form. The report outlined the work of a model school for manual training, in which a portion of the time is given to mental training, so that when a man is fitted for the work he expects to follow, he will also have a mental training that will fit him to be something besides a hand in the factory. Manufacturers and railroad men prefer boys trained at these schools and they stand higher than others from the beginning, with an opportunity to advance. They are prepared for co-operation of brain and hand, are skilled in the matter of learning and are, therefore, in position to acquire a knowledge of anything more readily than without the training. There is a great opportunity for men of wealth to use their money in establishing such schools and for the public schools to put in such departments to fit their boys for lives of usefulness.

Prof. Williston, another member of the committee, spoke of the organization of the National Society for Industrial Education, formed last November in Boston. Many different types of schools, he said, will be needed to meet the demands in the many different localities and conditions.

Mr. Albert G. Wessling, assistant engineer of the Allis-Chalmers Company, spoke of the student apprenticeship from the manufacturers' standpoint, a topic similar to that discussed by Mr. Gingrich. He first gave a description of a model factory, and then how necessary it is that the engineer understand every step in the course from where the raw material is secured to the accounting and publicity departments. Demands are made upon him from all departments. The man who has received the practical training to be had in the shops is well armed for the questions that will come to him later on, and for originating new devices and planning improvements that will meet the product of competitors. Opportunities are always open in that direction and the trained man may make himself more valuable in proportion to the skill he has in seeing and meeting these questions.

The speaker described the instruction given students in the electrical department, where they begin in the commutator department, then go to the winding department, and so on, each time going to work that is more difficult than that just left until finally they are drilled in the business offices. Lectures on various subjects are delivered and they are given every op-

portunity to learn the practical end of the business thoroughly. No college can turn out full-fledged engineers, he said, and the only way that thoroughly trained engineers can be secured is by putting them into the shops while they are in college that they may learn all together.

Charles E. Downton, foreman of apprentices, Westinghouse Electric & Manufacturing Company, spoke of the department that has been organized by that concern especially for training young men in the work. There are two classes of apprentices that come to the department, technical and non-technical. Mr. Downton said that the schedule of work laid down for these men did not cover the entire range of the factory, but, on the other hand, they are taught to do certain portions of the work well. In the engineering course, the men are taken up where they leave their work at college and given the practical side of the work, and taught how to handle men. This is one of the important features of the engineer's training. The men are assigned to work with others and trained so that they will be able to fill vacancies whenever they occur. Should they fail at first, they are given another trial. Some of those who failed at first have afterward made very excellent men and are holding good positions. A club has been organized for the engineers and officers, which has proved beneficial in a social and economic way.

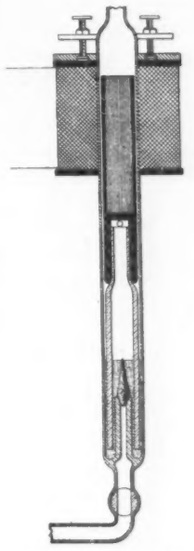
Apprentices are expected to remain until able to take a place in the plant, and 50 per cent of them are now with the company. The course requires two years, but this is not held to rigidly, conditions sometimes governing the disposition of the men.

The paper by Mr. Charles F. Scott, consulting engineer of the Westinghouse Electric & Manufacturing Company, dealt with many of the problems covered by preceding papers and especially urged that engineers should be able to handle men well. In this work they must come in contact with them and know them. Nothing will give them this advantage so well as to work in the shops with them. Mr. Scott also said that an engineer should be able to think out and execute new things. He deals with nature's materials and forces and must not allow precedent to bother him, but if possible step on ahead with ideas that will be valuable to his company. Education will train men to think, but they must use good, common sense when they begin their work in a manufacturing plant. The future engineer must be a larger man than those who have been able to take care of the work in the past.

The discussion following this paper was as to whether the colleges are able to prepare engineers so that they may take places without special training in the shops afterward. While all realized the value of such training, at the same time they felt that the schools are not so deficient in practical training that their men must take an apprentice course before they are able to take positions of any kind. In a general way the members indicated their belief that the schools are a very important factor in training engineers for all kinds of work, and that to a very large extent they are able to take up and succeed with work after leaving their colleges.

Valve for Vacuum-Tube Lamp.

A patent issued June 4 to Mr. D. McFarlan Moore, gives considerable information concerning the type of valve employed for admitting gas in limited quantities to a Moore vacuum-tube lamp. This automatic feeder valve, which was mentioned briefly on page 865 of our issue for May 4, 1907, is shown in vertical section in the accompanying illustration. The essential elements of the valve consist of a porous pencil of arc lamp carbon and a seal of mercury, which covers the tip of the pencil when the valve is "closed" and allows the tip to be exposed when the valve is "open." The vacuum-tube lamp, to which minute quantities of a certain gas are fed as desired, is connected to the lower extremity of the valve, while the receptacle from which the gas is obtained is joined to the upper extremity. The influx of gas to the vacuum-tube is regulated by an electromagnet, whose plunger serves for moving a displacer into or out from the mercury according to whether the valve is to be "closed" or "opened." With the displacer in its lower position the mercury completely covers the tip of the carbon, but when



VALVE FOR VACUUM-TUBE LAMP.

the displacer is raised the mercury surface becomes lowered and the carbon tip is exposed. The gas percolates through the mass of the carbon, so that there is no sudden influx of gas and no sudden fluctuation of the gaseous tension within the tube lamp.

Invention of the Telephone.

The recent death in Paris of Charles Bourseul, a retired employee of the French post-office service, recalls the days of polemic discussion over the invention of the telephone, in which the names of Bourseul and Reis occupied such leading places. The claims made for Bourseul rest upon the following passage from a paper which he published in 1854:

"Suppose that a man speaks near a movable disk, sufficiently pliable to lose none of the vibrations of the voice, and that this disk alternately makes and breaks the current from a battery; you may have at a distance another disk which will simultaneously execute the same variations. * * * It is certain that in a more or less distant future, speech will be transmitted by electricity. I have made experiments in this direction; they are delicate, and demand time and patience, but the approximation obtained promises a favorable result."

This was published some years before Philip Reis began his investigations. Writing in 1868, Reis said: "Incited thereto by my lessons in physics in the year 1860, I attacked a work begun much earlier concerning the organs of hearing, and soon had the joy to see my pains rewarded with success, since I succeeded in inventing an apparatus by which it is possible to make clear and evident the functions of the organs of hearing, but in which also one can produce tones of all kinds at any desired distance by means of the galvanic current. I named the instrument 'Telephon.'"

In the great suits involving priority in the invention of the telephone, the claims for Reis, based upon this publication, upon an article in the *Gartenlaube* and an illustration of his apparatus in the catalogue of an instrument dealer, were strongly pressed, the charge being specifically made that Bell had derived the idea of his telephone from one or more of these sources. On the other hand, other suits were based upon the allegation that an application for a patent filed by the late Elisha Gray was revealed to Bell by one Wilbur, an employee of the United States Patent Office. Neither of the above

charges were substantiated to the satisfaction of the courts.

The following note relating to Bourseul appeared after his death in the Paris edition of the London *Mail:*

"Some years ago M. Bourseul, who was living in retirement on his postoffice pension, asked for an audience of the Postmaster General. On being asked his name, he gave it as 'Bourseul, inventor of the telephone.'

"It was supposed that he was a harmless lunatic, but when he proved that he was a retired member of the postoffice staff, M. Mougeot caused an inquiry to be made into his antecedents, and was astonished to discover from the documents filed in the postoffice archives that the old fellow had spoken the truth, and that in 1854 Bourseul, after vainly offering his invention to the French postoffice, had published a full description of his invention in several technical periodicals. This detailed description is of far too technical a character for publication in the *Daily Mail,* but it will suffice to say that the principle of Bourseul's instrument—which he did not call the telephone—was absolutely identical with the telephone, the letters patent of which were applied for by Graham Bell at Washington on Feb. 14, 1876—or 22 years later.

"Bourseul, as is shown by the correspondence in the postoffice archives, spent five years in endeavoring to induce the French postoffice to take up his invention, but the authorities refused to take his invention seriously.

"On learning these details, M. Mougeot sent for the old gentleman, and asked him what he wanted. Bourseul complained that he found it difficult to make both ends meet with the small pension he was in receipt of. M. Mougeot, with the approval of the French Government, thereupon increased the old man's pension by £120 per annum, whereupon Bourseul returned in great delight to the country place to which he had retired.

"The president of the French Telephone Subscribers Association says that his death would probably have passed unnoticed but for the fact that Prof. Hodge, in a recent lecture on the telephone at Pittsburg, declared that the original inventor of the telephone was the Frenchman Bourseul. There is some question of raising a monument to Bourseul as the inventor of the telephone."

CURRENT NEWS AND NOTES.

OPERATORS IN DEMAND.—It is asserted that several thousand young men who are willing to prepare themselves can have an opportunity in the next few months of entering the railway service in a branch which has produced the greatest number of higher officials. The railroads of the country are face to face with the task of securing at least 6000 telegraph operators, and possibly double that number in the next nine months. This number of new telegraphers is necessitated by the new law which limits the hours of labor in this branch of the railway service. There is not a railway management in the United States that knows where or how it is going to get the large additional force needed. The fact is that there are not enough telegraph operators in the country at the present time to supply this enormous demand, and the problem is to create a supply as quickly as possible.

THE TELEGRAPH STRIKE.—Advices from Chicago state that the Commercial Telegraphers' Union decided on July 7 to postpone for one week its vote on the question of declaring a strike against the Postal and Western Union companies. Meantime the strike situation at San Francisco remains apparently unchanged. Two hundred union telegraphers at St. Louis, in executive session last Sunday, expressed confidence in the central executive and their readiness to obey strike orders immediately. U. S. Commissioner Neill has gone to the Pacific Coast to deal directly with the situation there. Later information is to the effect that the prospects for peace are not so bright. It is stated that Western Union Superintendent Miller at San Francisco refuses to meet a committee of the strikers because they are not company employees. The general situation is rather confusing.

ANTHRACITE DIMINISHING.—In some of our cities, like Greater New York, central station and traction companies are forbidden to use soft coal. But Mr. Edward T. Parker, the coal expert of the United States Geological Survey, predicts that at the present rate of consumption the anthracite deposits of the United States will be practically exhausted in 75 years. He urges manufacturers to use bituminous coal and declares that the smoke nuisance will soon be abated as a result of experiments now being conducted. Commenting on these figures, Dwight T. Randall, engineer in charge of smoke abatement, Geological Survey, said: "There is evidently not enough anthracite coal in the country for power purposes in the large cities of the East. In 1905 New York city burned 9,000,000 tons of anthracite coal and 3,500,000 tons of bituminous. This ratio has already changed and will continue until bituminous coal is in the ascendancy. It is estimated that New York and Philadelphia are now using one-fifth of the total yearly production of anthracite. Thus it is seen that we must conserve the hard coal if we wish it to last any length of time. We have found it entirely feasible to abate smoke in power plants, great and small," continued Mr. Randall, "but it is next to impossible to prevent smoke issuing from the chimneys of residences burning soft coal. Therefore it would seem that the logical thing would be to utilize the rapidly waning supply of hard coal for the homes and use the soft coal in the factories and power plants. The real problem before the East is the abatement of smoke from soft coal. New York is now showing that this can be done in the experiments that are being conducted by the New York Edison Company."

A TELEGRAPH TRUST is now alleged to exist by Attorney-General Jackson, of the State of New York. On his application this week, Supreme Court Justice Platzek made an order appointing R. Burnham Moffat a referee to hear evidence before the beginning of an action against the Western Union and Postal Telegraph Companies, which the Attorney-General proposes to bring to set aside certain contracts which, he declares, the two companies have entered into for the fixing of message rates. These agreements, he declares, are in restraint of trade and in violation of the anti-trust laws of the State of New York. The order requires all of the officers and directors of both companies to appear before the referee, and each officer is named separately. In addition, the proprietors of the big hotels in New York City are commanded to appear before the referee and produce before him all agreements, contracts, letters or other papers concerning the contracts which they have with either company for sending or receiving telegraphic messages in their hotels. The date for the first hearing is set for July 16, in the office of the referee, 63 Wall Street. The petition of the Attorney-General sets forth that the two corporations, the Western Union and the Postal Telegraph & Cable Company, are supposed to be rival corporations, organized for the purpose of transmitting telegraphic messages. About Jan. 1, of this year, he declares, the two companies entered into an agreement that hereafter they should mutually agree upon and enforce a tariff for messages, and that this tariff should be binding on both companies. The Attorney-General goes on to show by comparative tables the rates charged by both companies before the alleged agreement was entered into and afterward, and declares that the rates were increased, in many cases more than 20 per cent. He further alleges that when this contract was entered into the two companies agreed to establish offices to be used by them in common and for a division between them on a basis to be agreed on of the profits and receipts of such common offices. He adds that thereby a monopoly in the business of transmitting telegraphic messages was created and is now being maintained by the two companies. His action to restrain the carrying out of this monopoly, he says, will be brought in New York County, for the reason that the offices of both companies are here.

WIRELESS IN JAPAN.—A wireless station has been established at Choshiu, Japan, to communicate with American liners at sea over a maximum distance of 100 miles.

CONSOLIDATION IN JAPAN.—The Tokyo Electric Light Company and the Tokyo Electric Power Company have been amalgamated. A movement is on foot to include the Tokyo Electric Railway Company in the consolidation.

JAPANESE WIRELESS TELEPHONE.—Mr. Taka Shojiro, of Tokyo, has, according to a Japanese journal, invented a wireless telephone which is claimed to give results superior to any of the forms which have been invented abroad.

ELECTRICAL INDUSTRY IN JAPAN.—According to a consular report, there were organized in Japan during March, new electric railway companies with a total capitalization of $650,000, and new electric power companies with a capitalization of $100,000.

LABOR TROUBLES IN JAPAN.—The Japanese government has recently met with much difficulty in dealing with labor troubles. A recent incident was a conflict between two bands of workmen employed in the construction of the works of the Hakone Water-Power Electric Company, one of which attacked their opponents with dynamite bombs, killing and wounding a number of them.

NEW EDISON PRIMARY BATTERY.—A patent issued July 2 to Thomas A. Edison describes an improvement of the Lalande-Chaperon primary battery, known in this country as the Edison-Lalande battery. In this battery the electrodes are zinc and copper oxide in an electrolyte of potassium hydrate. The improvement consists in adding to the electrolyte about 15 per cent of silicate of potash, whereby, it is stated, the capacity of the solution for zinc or its solvent power is more than doubled, thus enabling a cell of a given ampere-hour capacity to be made much smaller. Instead of copper oxide, nickel hydroxide may be used. The superior results attained are ascribed to the formation of a double salt of zinc, silicon and potassium, which is much more soluble in the alkaline solution than the single salt of zinc and potassium and zinc.

THE BUSINESS OUTLOOK.—Judge Gary, chairman of the board of directors of the U. S. Steel Corporation, in an interesting interview this week said with regard to the present industrial activity: "It would be surprising if, with the prevailing conditions, there should not be some diminution in the volume of business during the remainder of this year. The business of our own company during the last six months has exceeded that of the first six months of last year, and we know that in 1906 there was a great deal of business done. I had all the presidents of our constituent companies here last week for a general talk over the situation before my departure. Every one of them was exceedingly optimistic. They could see nothing ahead but sound conditions and enormous continued business. Next year is a Presidential election year. This has always had the effect of causing a curtailment of orders during the latter part of the preceding year and the first part of the election year. Business men do not care to undertake new enterprises or order quite so heavily in the face of uncertain political conditions. The second point is that we have been doing too much business for the amount of money that has been available to finance our needs. It is well enough known that various corporations, among them many railroads, have had difficulty in securing capital requisite to their continued growth on the scale that has prevailed. We, fortunately, have not experienced this difficulty. The increase in the volume of money in the world has not kept pace with the increase in the volume of business. Companies have not been able to obtain funds to make the purchases they would like. This necessarily leads to a cutting down of orders to some extent. But the railroads and other corporations have been forced to continue to purchase large quantities of current supplies, even though they have been forced to pay very high rates for the money required." Judge Gary alluded also to the lesser activity in building and the effect of radical, socialistic agitation.

THE PUBLIC UTILITIES BOARD of Greater New York, in which so general an interest is felt, has taken hold of its new duties in a vigorous manner. Beginning its second week of existence with its first open session, it has passed several important resolutions. In effect the board has called upon all traction and gas corporations within the district to submit to it copies of their accounts and records; requested, within two weeks, copies of all traction operating and equipment schedules; started the work of the inspection of gas meters upon a systematic basis, and arranged for the appointment of committees to take up what are possibly the two most important traction "problems" in the city, the bridge crush and the construction of the Fourth Avenue (Brooklyn) subway. The governor has sent to the State Senate for confirmation the names of the men he appointed on the Public Service Corporations. In his message he announced for the first time the terms they were to serve. The members of the New York City Commission will serve as follows: Chairman W. R. Willcox, 1913; William McCarroll, 1912; Edward Bassett, 1911; Milo Roy Maltbie, 1910; John E. Eustis, 1909. The terms of the up-state commissioners will be: Chairman Frank W. Stevens, 1913; Charles Hallan Keep, 1912; Thomas Mott Osborne, 1911; Martin S. Decker, 1910; James E. Sague, 1909.

NATIONAL ELECTRICAL CONTRACTORS.—The National Electrical Contractors' Association will hold its seventh annual convention in New York on July 17, 18 and 19, when a very large attendance is expected. Headquarters will be at the Imperial Hotel, and the business meetings will be held at the Engineering Societies Building. The first session, which will be open to everyone interested in the electrical business, will be called to order at 10 a. m., July 17, by Mr. J. C. Hatzel, chairman of the National committee, who will introduce Mr. James Hilton, president of the Electrical Contractors' Association of New York State. Mr. Hilton will welcome the members and guests on behalf of the State Association, and turn the convention over to Mr. James R. Strong, president of the National Association. Professor George F. Sever, consulting engineer of the City of New York, will address the convention on the relations between the municipality and the electrical contractor. Mr. Arthur Williams, past president of the National Electric Light Association, will speak on the relations of the lighting company and the contractor, and will be followed by Mr. J. Robt. Crouse, who will explain the work of the Co-operative Electrical Development Association during the past year. This will terminate the morning session, and in the afternoon there will be a business meeting. At 10 a. m. on July 18, there will be another open meeting, and addresses will be made as follows: Mr. T. C. Martin, of the ELECTRICAL WORLD, on the relations between the press and the electrical contractor. Mr. C. M. Goddard, secretary of the Underwriters' National Electrical Association, will speak on the relations between the underwriter and the contractor. Mr. C. L. Eidlitz, first president of the National Association, will speak on the subject of that body. The remaining sessions will be occupied with executive business. On Wednesday, July 17, there will be a river trip for the ladies in the afternoon, and in the evening there will be a dinner at the Waldorf, followed by an amateur vaudeville by members. On Thursday, there will be an automobile ride for ladies in the afternoon to Coney Island, and in the evening, for members, a smoker at Shanley's, after the business session. On Friday there will be a trip up Long Island Sound by boat, with clam bake and baseball game, East against West, by members.

THE MICHIGAN ELECTRICAL ASSOCIATION.—The Michigan Electrical Association will hold its convention this year at Battle Creek, Mich., August 21, 22 and 23. The Post Tavern will be the general headquarters, and the sessions of the convention will be held in the Business Men's Association Rooms in the Post Building, directly across the street from the Tavern.

SMELTING IRON ELECTRICALLY.—A dispatch from San Francisco, dated July 4, states that the electric process smelter at Heroult, on the Pitt River, 18 miles from Redding, Cal., started up on that day. The smelter cost $70,000 and is the first of its kind to be established on a commercial basis. The success of the smelter, which is still somewhat experimental, means a great deal to California. There are mountains of iron ore along the Pitt River which could never be smelted in the old way because of the cost of coke.

ENGLISH TELEGRAPHY.—The latest financial statement of the British post-office telegraphs shows that for the third year in succession the loss sustained on the service has amounted to more than a million pounds, although the receipts for the year were the largest ever known, reaching a total of £4,151,376. A review covering 37 years is included in the return, and shows that the total loss on the service during that period has amounted to £14,271,827. About eight millions of this loss is accounted for by capital expenditure, but the remaining six and a half millions is dead loss on the working of the system.

A LONG DISTANCE SIGN.—It is stated that a very striking "sign" or lighting fixture will crown the office building of the Columbia Gas & Electric Company, in Cleveland, Ohio. The building will be 60 ft. x 100 ft. and will have 16 stories below the tower, the tower being equal to four stories more. From the dome of the tower will rise a statue of liberty, with a crown studded with electric lamps. The statue will hold a torch from which a flame of gas will burn constantly, and at the exact hour every hour in the day and night a flame of gas will rise 25 feet and remain burning one minute. The time will be observatory time, telegraphed from Washington and the time machinery entirely automatic. The flame will be visible for about twenty miles.

TESLA'S INVENTIONS.—In a further letter, of July 2, to the *New York Times,* Mr. Nikola Tesla says: "I am receiving so many notices and inquiries on the subject of Martian signaling that I shall be much obliged to you if you will kindly refer those who have taken occasion to comment upon this feature of my letter in the *Times* of Sunday, June 23, to the March number of *The Harvard Illustrated Magazine,* in which I wrote a short article in response to repeated requests of the editor. What I have stated in that publication and others mentioned therein is all I care to say now, despite tauntings and temptations. A full technical report descriptive of my apparatus and results of observations I have particular reasons to reserve for two old institutions—academies of science—of both of which I am an honorary member."

RADIUM SUBSTITUTE.—With respect to recent advices from Paris as to a cheap radium substitute, a special cable dispatch from that city, of July 6, says: "In regard to the discovery of a new radio-active compound, molybdate of uranium, by André l'Ancien, a medical student of Rochefort, concerning which I cabled you yesterday, Prof. Le Chatelier, of the College of France, states that it is of little importance, as the substance contains an infinitesimal quantity of radium—one gram in 40,000. L'Ancien, he says, merely hit upon a new compound such as is frequently discovered in chemistry. The latest estimate, made this week, of the present stock of pure radium-bromide is about 17 decigrams, of which one-third is on the market and the remainder in the hands of Mme. Curie and various scientists. The price quoted by dealers is $80,000 a gram, the output having ceased."

THE ELECTRIC RAILWAY IN JAPAN.—The project for electric railways which since the late war have been put forward in Japan aggregate an estimated expenditure of $390,000,000. The Tokyo Tramway Company recently started work on extensions to cost $1,000,000, and comprising 36 miles of track. The Buso Central Railway, which has started to build a railway from Sendagawa to Odawar, a distance of 53 miles, has decided to equip for electric traction instead of steam traction as first intended. An electric railway 15 miles long is to be constructed on Amaji Island. Work is under way to equip the present steam road between Yokohama and Kodzu for electric cars in addition to steam trains. The Yokohama Railway Company has been granted authority to extend its lines to Kamakwra and Kanazawa. For this purpose the capital of the company will be increased to $1,000,000, making a total capitalization of $1,500,000.

MACHINERY CLUB.—The Machinery Club has been organized for the purpose of providing a pleasant place of common resort for entertainment in the heart of the business section of New York, conveniently located to most of the offices of the concerns interested in the various branches of the machinery and metal trades. Quarters have been engaged on the 20th and 21st floors and provisionally on the 19th floor of the Fulton Terminal Building on Church Street. The space reserved, from 36,000 to 54,000 sq. ft., is ample for lunch and grill rooms, library, assembly rooms and possibly a few bed rooms for the use of out of town members. The club will primarily be a luncheon club, but it is also expected to be a general rendezvous for the machinery trade in New York City. The resident members are limited to 750, suburban members to 500 and non-resident members to 1000. The House Committee consists of Messrs. T. N. Motley, P. A. Ware, E. H. Benners, C. A. Schieren, Jr., and G. A. Howells. Messrs. J. R. Vandyck, G. L. Gillon and C. E. Crook form the membership committee, the present address of which is 26 Cortlandt Street.

OWNERSHIP IN INDIANA.—A special dispatch from Indianapolis, of June 30, discusses the ill-luck of some 12 Indiana municipal plants. After pointing out the main causes, it says: "The constitution of Indiana fixes a limit of 2 per cent to the indebtedness of municipal corporations, and beyond this they cannot go. When the rush for municipal plants began nearly all the cities were dangerously near this limit and some having passed it, purchased plants on the instalment plan and levied taxes to meet the indebtedness as it came due. As a rule these plants were run down and from the first repairs had to be made, as at Washington and Peru. Then, again, those economic devices that private capital is always quick to take advantage of were out of reach of these cities because of the scarcity of money, and the service by comparison was poor and the patrons constantly becoming more dissatisfied. Some of the developments in connection with municipal ownership in Indiana would be very amusing were it not for the serious consequences that flow from them to that already overburdened individual—the taxpayer. For instance, when the new administration was installed at another city the discovery was made that the city was carrying $124,000 insurance on the electric light, waterworks and filtration plants. On an immense water tank, made of cement and assumed to be full of water all the time, there was an insurance of $26,000. It couldn't have burned if the whole city had turned out with firebrands and thus attempted to destroy it. The city waterworks was insured for $32,000, with all the probabilities of fire against it. There was $66,000 insurance on the electric light plant, though employees were always present and such a loss by no means probable. The new board reduced the insurance and saved $4,000 in premiums. The secret of this heavy insurance lay in the fact that a member of one of the city boards was the agent for the insurance company that was carrying the 'risks.'"

The New Building of the Boston Edison Company.

WITH a second-hand boiler and engine in an abandoned stable at the end of a dark alley, the Edison Electric Illuminating Company of Boston began its career in February, 1886. The first lighting service was given at the Bijou Theater, and the work was personally supervised by Mr. Thomas A. Edison. To-day the company serves 30 cities and towns in the Boston metropolitan and suburban district, covering a territory of 450 square miles and supplying a population of 1,000,000. At the beginning the company supplied the energy for 627 incandescent lamps, or less than what is now used on a single floor of a modern department store, and in many residences in the district. The company now has an alternating current connected load of 17,300 kw and a direct current connected load of 62,700 kw. The underground service is unique in style of architecture, convenient arrangement of offices, electric installation and elevator service. Fig. 1 gives a perspective view of the building, and Fig. 2 a view of the show window. The architects were Messrs. Winslow and Bigelow, of Boston, and the consulting electrical, heating and ventilating engineers were Messrs. Densmore and Le Clear of the same city. Whidden & Company of Boston were the general contractors, the electrical installation being carried out by Herbert S. Potter, Boston. The arrangements for general interior illumination and the design of the fixtures were in the hands of a special lighting committee, composed of Dr. Louis Bell, Boston; Mr. W. D'A. Ryan, Lynn, Mass., and Mr. L. B. Marks, New York.

The building has a frontage of 45 ft. and rises to a height of 125 ft. Indiana limestone was used for the solid portion of the front, although this is but little more than an outline, an unusual design having been followed in the glass installation.

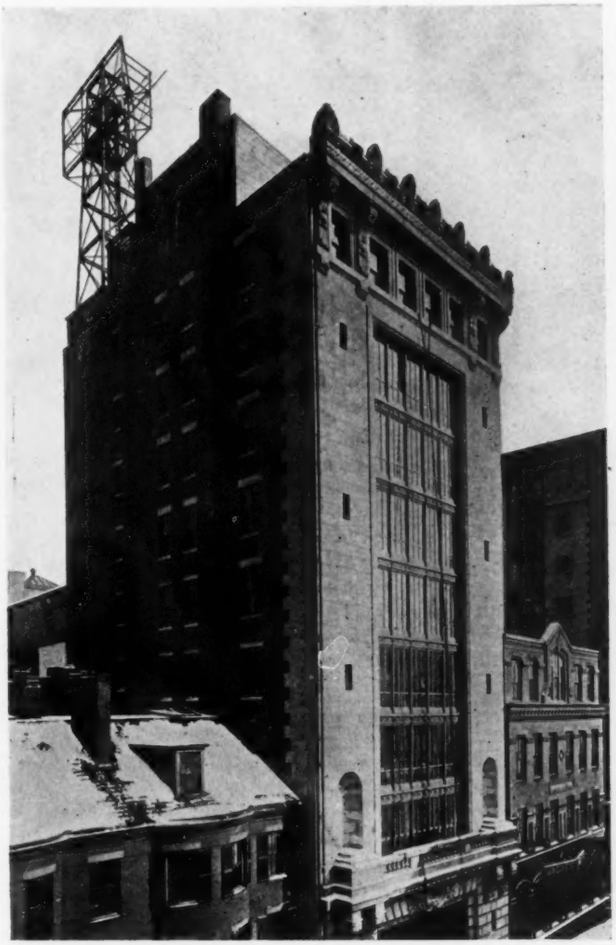


FIG. 1.—GENERAL VIEW OF BOSTON EDISON BUILDING.

FIG. 2.—SHOW WINDOW, BOSTON EDISON BUILDING.

has been increased until at present the company has $5,000,000 invested in distributing circuits and conduits out of sight beneath the pavements. The sale of power became an appreciable feature of the company's business in 1887. In June, 1901, the Boston Electric Light Company's plant and business were purchased by the Edison Company, and this consolidation was followed by many improvements in the service and extension of the supply into the suburban districts. Since the original station of the company at Head Place was shut down for about 20 hours in 1888, there has not been a complete cessation of the service at any time.

The growth of the company's business has necessitated the erection of a new ten-story modern office building at 33-39 Boylston Street, Boston, and this structure is practically finished at the present writing. The new home of the company

The front of the building faces south, and the effect is largely that of a single sectionalized window 22 ft. wide, rising from the street level to the tenth floor. The individual panes are held in a bronze framework, the front of each story being separated by heavy bronze casements into five sections of six panes each. Three sections in each set can be opened, on vertical axes. Unusual delicacy of outline is the result. At the level of the third floor a stone balcony of ornamental design, with a pedestal at either corner supporting a large bronze lamp, forms the only important decorative relief on the front of the building. The top is finished with a modeled copper cheneau above the cornice. The soffit panels of the cornice will be illuminated in the evening and the cheneau will also be silhouetted with lamps. The design of the façade is especially adapted to elaborate electrical display. On the top of the roof is a steel

tower 51 ft. high, upon which an illuminated sign, "Edison Light," is mounted, the letters being 4 ft. high and the sign visible legibly for more than three-quarters of a mile.

The building is provided with two entrances, one at either side of the large plate glass window of the exhibition room, which is on the street level. One entrance leads directly into the exhibition department; the other into a marble vestibule and corridor flanked on one side by the elevators leading to the offices and on the other by a glass partition which forms the west wall of the exhibition room. This partition is provided with doors, also leading directly into the exhibition department. The general arrangement of the first floor is shown in Fig. 3. Immediately beyond the elevators are the cashier's desk and the general inquiry desk. These were placed on the first floor for the convenience of customers and inquirers who have not the time or the inclination to take the elevator to the offices above.

The second floor is arranged in one large room conforming in general design to the first floor. This room is given up to

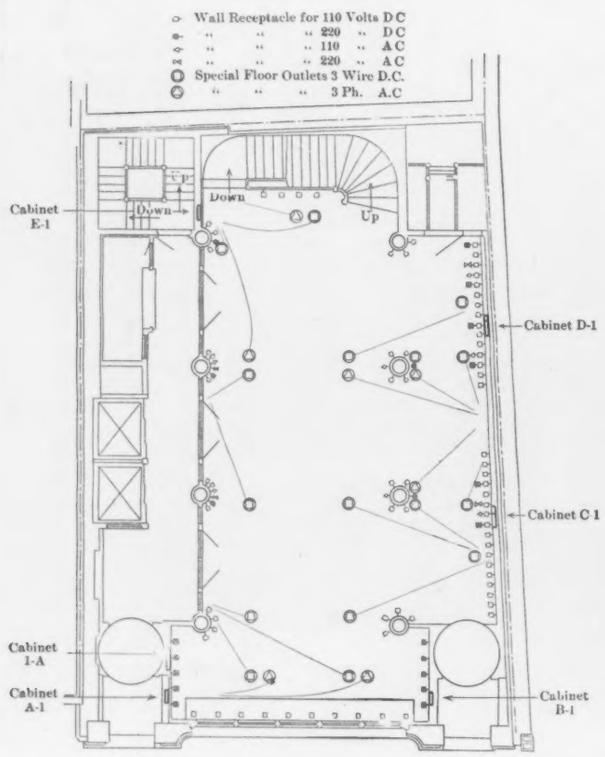


FIG. 3.—FIRST-FLOOR PLAN.

the city sales division and is provided with desks for the company's agents. The third floor is intended for a library and meeting hall. It is a high-studded room finished in white and has been fitted with the General Electric Company's "linotype" system of lighting, in which the lamp cylinders are concealed and continuous in a row around the wall of the room near the ceiling. The cornice is curved to render the lamps invisible, the rays being reflected from the curving surface in an even illumination throughout the room. Besides being intended for a library, this room will also be used as a lecture room and for the purpose of entertainment by the employees of the company. At one end a stage has been provided which will be equipped in a modest way with small set pieces and a drop curtain. The stage will be provided with 100 footlights mounted on swivels and controlled from a small dimmer switchboard located out of sight of the audience in a passageway at the side of the stage. A general wall cabinet for this room is located at the side of the switchboard, but the graded control of the lighting is effected from the concealed switchboard. The chairs for this auditorium are packed beneath the stage through trap doors in its surface. There will also be provision for a stereopticon whenever lectures are given for the instruction of agents. The balcony on the exterior of this room will be fitted with 40 lamps to serve as a welcome when the hall is open in the evening.

The fourth floor is devoted to divisions of the general agent's department. Besides a large open space in which will be the desks of a number of the special agents, office rooms have been provided for those who feel it necessary to be free from interruption. These include an office for the general agent, a large room for the members of the division of statistics, another for the division of claims and adjustments, and one each for the special agent in charge of new buildings and the suburban district manager.

The fifth and sixth floors are devoted to the auditor's division, and are arranged in a most convenient manner, with ample desks and complete lighting facilities for such a department. The seventh floor is given up to the private offices of the superintendent of the operating bureau. The main office of the information division is also on this floor, together with an assembly hall, which is illustrated in Fig. 4. This room is to be used for gatherings of department heads, special guests, etc., and it is handsomely furnished with Mission style chairs, tables, divans, etc. Large portraits of President C. L. Edgar and Mr. Thos. A. Edison adorn the walls, with other photographs of interest. In one corner of the room is a kitchenette equipped with a Simplex electric cooking outfit large enough to take care of 50 persons. The eighth floor is given up to the purchasing department, the ninth to the installation and construction department, and the tenth to the drafting department. This latter

FIG. 4.—ASSEMBLY HALL.

floor is specially suited for this class of work, being at the top of the building.

The office employees at present number about 400. The company's old building at Head Place is connected with the new Boylston Street office building by a covered passageway at about the sixth story. At Head Place are the offices of the electrical engineering department, the laboratory, photometer room, transforming station, stock room, superintendent of underground lines, meter and arc lamp stock, stenographic, mailing and filing divisions. The company's private branch telephone exchange is also located here. This is a department store or relay type of switchboard, and it consists at present of two sections, each accommodating two operators. The full capacity of the board when extended will be six sections or twelve operators. The board is of the common battery type and there are at present 60 trunk lines connected with the Oxford Exchange of the New England Telephone & Telegraph Company's Boston district. The switchboard is operated continuously day and night.

Two electric elevators of the new Otis traction type have been installed for the convenience and comfort of customers and em-

ployees of the company. Each elevator has a lifting capacity of 2500 lbs., at a speed of 500 ft. per minute, and the winding drums are located directly on the ends of the motor shafts, which gives a more rapid acceleration than has heretofore been practicable with electrically-driven elevators. The elevator motors are located in a special compartment on the roof of the building and each machine is driven by a 150-ampere, 220-volt, direct-current motor making 625 r. p. m.

The exhibition department is undoubtedly the most interesting feature of the new building from the central-station standpoint. For several years the company had maintained attractive display rooms at its Head Place offices, and when it was decided to erect the new building it was settled that the space assigned for the education of the public in the uses of electricity should be the most prominent in the whole plan. The crowds of onlookers at the front window of the department and the large number of visitors who have already inspected the new quarters indicate that a wise selection of location was made in putting this department on the street level. Fig. 5 is a general view of the exhibition room as it appears from the Boylston Street window, excluding the apparatus in the window itself.

FIG. 5.—EXHIBITION DEPARTMENT, BOSTON EDISON BUILDING.

The exhibition room is one of the most carefully arranged for its uses in the country. It is about 54 ft. long and 30 ft. wide, the height being nearly 20 ft. Both the first floor and the basement are to be used for exhibition purposes. In the basement provision has been made for the display of such heavy apparatus as large individual motors, ice crushers, coffee mills, bread mixers, large fans, vacuum cleaning apparatus, arc lamps, large signs and other bulky appliances which perhaps do not interest the casual visitor or the purchaser of ordinary electric convenience as much as the heavy power customer. The first or main floor of the exhibition department is finished in Greek detail with eight large columns of Alps green marble with white capitals. A cornice extends around the ceiling supported upon these large columns, and giving a beautiful yet substantial appearance to the room. Everything except the columns is finished in white, while the brilliance of the illumination is increased by eight arc lamps set in concentric diffusing shades recessed in the ceiling. To enable the effects of incandescent illumination to be studied, the capitals of the columns are outlined with frosted incandescents mounted in special outlet boxes as close together as possible. At the rear of the exhibition room is a balcony landing with stairways leading both to the basement and the second floor.

Efforts are being made by the company to have at least a sample of every practical electrical appliance in the exhibition department, and manufacturers interested in this line of work have been given an opportunity to place their products here. In the electrical installation in the new building no peculiar or extravagant schemes were followed, but the aim has been to show clearly just how any modern office building can be equipped for the convenient and economical use of electric light and power. Thus, the ventilating system was designed to permit easy inspection by the public, different styles of distributing cabinets were installed in the exhibition room for purposes of comparison, the elevator machinery can be seen by any one who is interested, and in the basement are also shown a motor-driven vacuum cleaning system and a sump pump of the automatic electrically operated kind. In the ordinary office building this apparatus is almost always installed out of sight of the public. The heating system is the direct radiation type, regulation being by automatic temperature control. Fresh air is drawn into the basement, screened and delivered to the rooms at approximately normal room temperature. The 140-in. suction fan in the basement is direct driven by a slow-speed General Electric motor which is mounted in the exhibition section. At the top of the building is a plenun. chamber containing a 60-in. disk fan driven by direct connection on a vertical shaft by a 3.5-hp, 220-volt, 150-200 r. p. m., direct-current General Electric motor. The vitiated air from the building is drawn out of the various room ducts into this plenum chamber and forced into the external atmosphere through louvres.

The general wiring diagram of the building is shown in Fig. 6. The requirements of lighting and power service in the ex-

hibition department greatly modified the wiring installation for the utmost flexibility of service with ample capacity for supplying electricity to future apparatus whose consumption is more or less indeterminate were essential. The general switchboard for the building is located in the exhibition room basement, and part of the connections to this board at the sub-base have been left exposed for the purpose of showing visitors the details of such construction. The switchboard is 25 ft. long and it is composed of eight panels of pink marble. At one end of the board, recessed in the wall behind, is the direct-current street-service panel and main cut-out cabinet for direct-current service. The alternating-current service board is at the opposite end, occupying panels 7 and 8. Proceeding from left to right

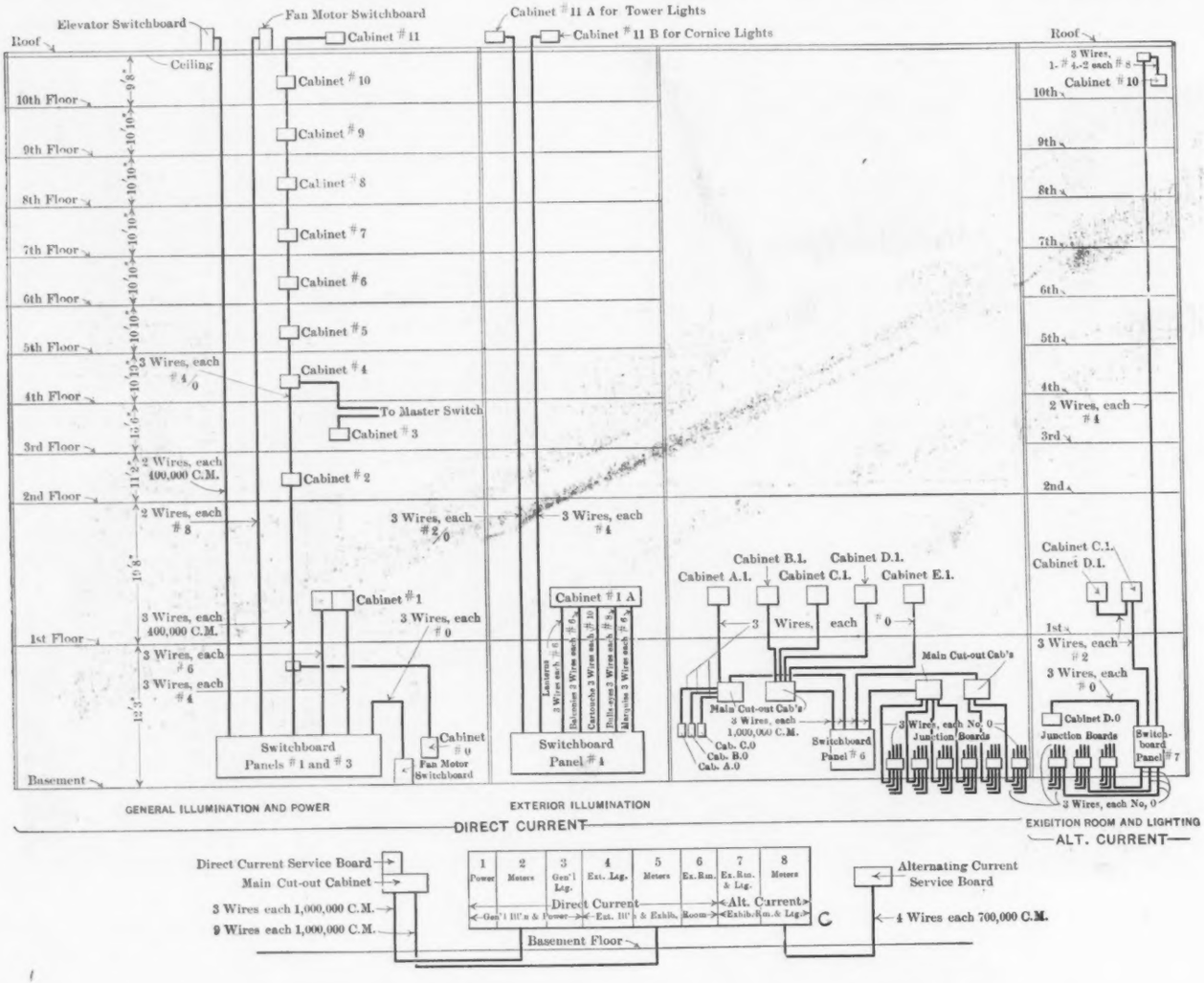


FIG. 6.—WIRING DIAGRAM OF MAIN SWITCHBOARD, SHOWING SERVICE CONNECTIONS.

as in Fig. 7, which shows the main switchboard in elevation, the service of the various panels is:

1. Power, basement and roof fans, elevator motors.
2. Meters, internal lighting and power, demand indicators.
3. Internal lighting, arcs, incandescents, illuminating.
4. Exterior lighting, balconies, marquise, riser, bull's-eyes, lanterns, cornice, tower, cartouche.
5. Meters, exterior lighting and exhibition apparatus, demand indicators.
6. Exhibition appliances, main cut-out switches.
7. Junction board exhibition apparatus. Tenth floor, alternating current lighting riser.
8. Alternate-current meters and demand indicators.

This grouping enables the company to learn for its own information or for demonstration the current and energy consumption of the various services in both temporary and integrated loads, and it shows in operation how much energy is consumed in the various advertising departments, both exterior and interior. Both indicating and recording instruments are liberally used on the switchboard. It was not considered necessary to install double-throw switches and duplicate bus-bars, so the wiring scheme from the purely electrical standpoint is simply one of subdivision along orthodox lines. The amount of energy liable to be demanded, however, together with the varied voltages and services needed, called for skillful engineering in the mechanical disposition of the various circuits.

From the main direct-current cut-out cabinet three 220-110-volt 1,000,000 circ. mil cables feed the second panel of the switchboard by conduit run beneath the floor, supplying the energy for general illumination and power in the building as an office structure. The direct-current service for the exhibition department is likewise fed at the fifth panel by nine 1,000,000 circ. mil cables, 220-110 volts leading from the main direct-current cut-out cabinet. Four 700,000-circ. mil cables carry 220-110-volt alternating-current power from the alternating service board to panel 8. All wiring is carried in armored conduit.

The general distribution scheme is well illustrated in Fig. 6. The elevator motors at the top of the building are served by a pair of 400,000-circ. mil risers which are run as an independent circuit from the switchboard. The plenum chamber fan motor on the roof is also served by a separate pair of No. 8 risers. The general lighting of the floors from the second upward, including the second, is handled by a three-riser set diminishing in section from 400,000 circ. mil to No. 4-0 beyond the fourth

floor. The general lighting of the exhibition department is supplied from the office building side of the switchboard, the company having decided that this illumination ought to be included as regular consumption and not as advertising lighting. The exhibition room lighting cabinet is served by three No. 6 wires and by three No. 4 leads, incandescents and arcs being separately controlled. The basement is supplied by a branch from the illuminating riser, and the basement fan motor by three No. 0 wires leading from the switchboard.

Separate sets of three-wire risers are run from the main switchboard to the roof to cabinets controlling the tower and the cornice lamps. The tower circuit consists of three No. 2-0 wires and the cornice feed is No. 4 section. The lanterns, balconies, cartouche, bull's-eye and marquise lighting are all controlled from a cabinet in the exhibition department, three-wire risers varying in section from No. 6 to No. 10 being run to this cabinet from the switchboard.

The exhibition department is provided with a large number of floor outlets, wall and column receptacles for alternating and continuous current at voltages of 110 and 220. Fig. 3 illustrates the arrangement of these in the exhibition room at the street level. All receptacles differing in current characteristics are so designed that the wrong plugs cannot be inserted in them, and are provided with metal plates numbered and lettered according to the current and voltage. The columns in the main exhibition room are liberally provided with wall outlets arranged radially for the different classes of service. All outlets are designed to carry a much larger current than any single piece of machinery in the room is likely to demand for some time to come. The floor receptacles are supplied through conduits run in the floor, and these outlets are of a special design, which enables additional circuits or extensions to be made on the ceiling beneath, without obstructing the main floor above. In general, the exhibition room is supplied from one panel of the switchboard through four three-wire 1,000,000-circ. mil circuits which terminate in four main cut-out cabinets located in the wall behind the main board. A clearance of 4 ft. separates the main switchboard from the wall. From the main cut-out cabinets five three-wire No. 0 circuits lead to the street floor cabinets, three circuits of the same size lead to cabinets in the basement, and six circuits lead to junction boards in the basement walls, whence feeds are run upward to the first floor and longitudinally to the outlets in the basement floor. The same general plan was followed with the alternating-current service, working from the seventh switchboard panel. Two No. 4 wires are run as a riser pair to the drafting room, so that if desired the company can use alternating current lamps in this department. Outlets are in general supplied from cabinets by independent branches. Behind the switchboard a spring was unexpectedly struck in excavating, and it was necessary to install a sump and automatic pump at this point to take care of the drainage. This outfit is one of the exhibits, and its operation by a 1-hp, 230-volt motor is frequent enough to be of interest to the visitor who is concerned with such details. One of the devices installed is a large gas meter, with connections so that the superiority of electric illumination over gas can be demonstrated. At one side of the basement are two rooms which will probably soon be equipped for color examinations and comparisons of different styles of shades and lamps. The main exhibit floor already contains a large variety of apparatus, including a General Electric kitchenette, Simplex kitchenette, heating appliances, small motors, electric signs, flashers, washing machine, electric light bath, hair-drier, refrigerating equipment, meters, photographs of the company's property, coffee mill, etc. Free copies of the company's monthly publication, *Edison Light*, are also distributed here.

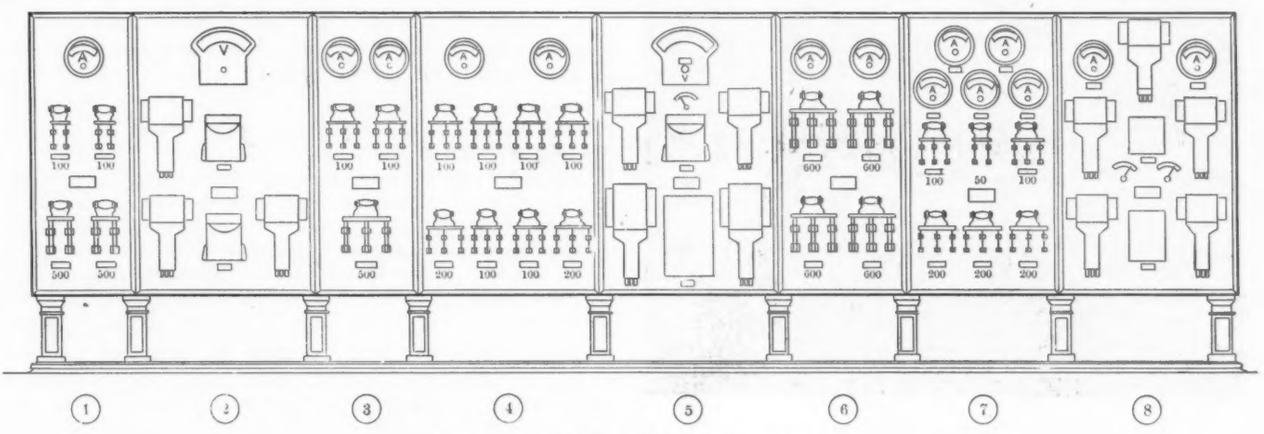


FIG. 7.—ELEVATION OF MAIN SWITCHBOARD.

Arc Lamps for Railway Car Illumination; Their Distribution and Characteristics.

BY ALFRED L. EUSTICE.

The use of electric lamps for illuminating railway cars has been on the increase for some years, and at the present, owing to the luxury of trains in general, the electrical engineer is heeding the constant demands of the public and concentrates his efforts along the lines of more efficient illumination. The American engineer has possibly given less attention to car illumination than some foreign countries, but one must bear in mind the different conditions which exist that brought about electrical car illumination for general use. The roads in foreign countries are very short, as compared with many of our great railway systems, thus enabling the use of a battery equipment with little difficulty, and small cars permit the use of fewer units.

For several years the incandescent lamp has held the field of electric car lighting, but its sphere of general usefulness has recently been entered by the electric arc which promises to be an aggressive factor in this class of work in the future. Although the electric arc was the first form of electric lamp known, it is only the recent developments of the enclosed arc that have placed it where it can be used under exacting indoor requirements. The long life of the carbons; the development of the smaller units of the enclosed type, the good regulation secured, and the good diffusion of light secured by the aid of modern glassware, all add to the value of the enclosed arc for car illumination.

A system of arc lights has recently been installed in a car on the Chicago & Northwestern Railway running between Chicago and Waukegan, which has many features and characteristics that receive more than passing attention and form a subject of general interest in railway circles. The test for distribution, etc., the results of which are discussed farther on, was performed by the writer, the test being instigated by the Universal Electric Storage Battery Company.

The car, an interior view of which is herewith given, is of the

Pullman standard 55-ft. type, mahogany finished with red plush seats, light wooden blinds and the regular olive decorated top. The interior equipment consists of three small enclosed arc lamps, rigidly fixed in position upon the ceiling as shown, the customary protective devices and controlling switch being placed in the saloon in the end of the car well concealed from the public. The lamps are an adaptation of a regular type of lamp and are fitted with a somewhat special type of an opal shade. The entire lamp is mounted and braced so as to prevent vibration with respect to the car. Experience has shown that the vibration of the car itself has no effect upon the operation of the lamp, which is equally as good at standstill, low, or high speed.

The lamps are operated in parallel from a straight storage battery system, the rated capacity of which is 120 ampere-hours, placed in a compartment under the car. The compartment is 15 ins. high, 20 ins. deep and 65 ins. long, and contains 50 cells arranged in 5 trays of 10 cells each. The weight of battery equipment complete is 1350 lbs.

Since weight and space occupied are two points of great consideration in car work, a comparison between the arc system and others may be of interest. The average battery for incandescent lighting with an axle dynamo system occupies a space 24 ins. deep, 18 ins. high and 96 ins. long, and consists of 16

FIG. 1.—VIEW OF INTERIOR OF CAR.

cells. Such a standard equipment would be 32 cells, normally 60 volts rated at 336 ampere-hours. This is the largest size in ordinary use. Each cell in this class of installation will weigh, complete with containing tray, about 165 lbs.

An incandescent light system which would give approximately the same light and distribution as the Pintsch gas light, would require a minimum of 20 16-cp lamps or would give a total wattage, per car, of about 1000. This number of incandescents would, of course, give only about one-third the light of the three arcs, but the illumination secured would be fairly satisfactory. However, the incandescents would require a battery weighing from 5000 to 6000 lbs., which is entirely too much weight to place on any car of average construction.

The life of the carbons in the small enclosed arcs used on the car will approximate 40 hours for positive and 40 hours for negative, or one new carbon every 40 hours. The cost of maintenance can be readily seen to be less than for incandescents where carbons are $16 per thousand, or about $3 to $4 per lamp per year and incandescents numbering 20 to 40 per car at 20 cents for each 500 hours.

The arc lamps approximate 200 cp each with globes complete, and have a consumption of 300 watts, giving about 1½ watts per candle. These three lamps replaced the former installation of five Pintsch gas units of approximately 36 cp each, or a total of 180 cp in the car.

The arc-light system is on trial service on a suburban run between Chicago and Waukegan for various reasons. In this class of work the lighting period is a great percentage of the total time the car is on the road. The passengers on these runs are very apt critics and from their actions the feasibility of the adaptation of the arcs can be determined. A point well in favor of the arcs is the fact that the passengers, 90 per cent of whom read their paper on the journey, will first fill the arc lighted car in the train, which is made up of several cars.

Suburban service requires many stops with consequent slow speed throughout much of the distance; hence, the axle-driven system of lighting would not be an ideal installation for incandescent light; and since the cars are in actual service about five hours per day, the straight storage battery would not be economical for incandescent lamps. The head end system requires that every baggage car be equipped with a turbine and generator and must be coupled up at all times. This condition cannot be filled when the train is standing in the shed. The car must be provided with adequate steam fittings and be placed next to engine. This system has the great disadvantage of using steam at the times it is most needed by the locomotive when on the road.

If the service were equipped with arcs throughout, the cars could run over two nights per charge so that they could be regularly located on a siding and have their exhausted battery replaced with a fresh charge, which would be at hand. A large station could be maintained so that a certain percentage of the batteries would be on charge at all times, holding a day's supply in reserve upon suitable trucks. The light weight and small size of the arc batteries would enable the refilling of the car compartment with great rapidity. In fact, on the car here described, the actual work of shifting is done in from three to four minutes and the car is always ready for the road in less than five minutes' time. Contrasted with the storage and axle-driven systems, the inspection of apparatus is of no importance, whereas the delicate controlling devices on the axle drive require expert attention after every trip.

The tests of the distribution of illumination in this car show well the features of the system and from a study of the curves one is enabled to judge the results that could be secured by making slight changes in the installation.

The results herewith given were secured while the car lay in the Waukegan yards with all conditions exactly as when the car is on the road. In fact, two things were detrimental to the best showing of results, namely, the lamps had not been trimmed for some time, the glassware was noticeably dirty and the battery was operated upon its last run before charge. A duplicate test was carried on in a car of the same type fitted with five Pintsch gas units, which were operating exactly in the same manner as when on the road and with glassware clean. The test in the car with the Pintsch gas system, however, was carried on solely for results that would be found in practice, no manometer or meter being placed in the system, for the object was merely to study the difference between the commercial results obtained by the two systems for the same car.

The intensity of illumination in foot-candles was secured by means of a "Weber" photometer which had been thoroughly calibrated in the laboratory before the trip. However, to insure that the standard, which is a miniature tantalum lamp operated on 3.8 volts, did not change, the accuracy of the calibration was checked in the laboratory after the return and the results then interpolated from the calibration curve of the instrument.

On account of the characteristic floating of the arc, the results varied to a slight extent for the same photometer setting. The floating spot, although quite apparent upon the globe, was not large enough to cast a noticeable shadow on the plane of the seats. A succession of readings was taken by the observer at intervals stated by the assistant while the floating spot

traveled completely around the globe. These readings were taken at seat No. 8, with only lamp No. 2 in operation, showing a difference of only .5 foot-candle intensity between maximum brilliancy and when the spot was directly in the plane of the photometer screen and the arc. This is a difference in intensity of about 21 per cent.

The photometer setting was maintained and the three lamps were put in operation and readings taken when the spot was such as to give maximum and minimum illumination on the screen. From these results, no record being kept of the position of spots of arcs No. 1 and No. 3, a difference of intensity of .32 foot-candle was secured, or only 14 per cent variation between maximum and minimum. From observations we are led to assume that only very infrequently will the spot from more than one lamp give a diminution of intensity in a definite direction. This difference shows the maximum effect, since it is the nearest position to the arc, and even 20 per cent in over 2 foot-candles is barely noticeable to even an experienced person.

The distribution of illumination throughout the car was assumed to be symmetrical with respect to the center line of the car, so that readings were taken on one side of the car only. The working plane was chosen in line with the center of the seats 30 ins. from the center line of the car and in the plane of the seat top which is 40 inches above the floor. This is about the height at which a person in a car will hold a paper when reading.

One arc is located in the center of the car at seat No. 8 and the two end arcs are 18 ft. from the center and 9 ft. 6 ins. from either end at seats No. 2 and No. 14 respectively. Instruments were in the line throughout the test, which gave an average e. m. f. over each lamp terminal of 96 volts and a total line current varying from 8.3 to 8.5 amperes, or about 1.35 watts per candle.

A photometer setting was taken at each seat throughout the length of the car with the diffusing screen in the above-named plane. In order to secure a fair average value of intensity of illumination, six readings were taken at each seat after a short interval of time, so that the arcs had ample time to travel and give an average value. The average value at the various seats can be seen in a glance at the accompanying curve.

An investigation of this curve will show that, while it is very good, yet it can be improved in general character. The average intrinsic value of the illumination is what may be termed brilliant in this class of work, which shows that units with lower candle-power would serve the purpose equally well. Midway between the arcs will be seen a break in the general form of the curve which would be materially helped by the addition of another unit.

A mirror is located near seat No. 15 in the end of the car,

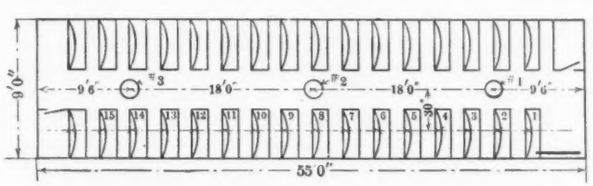


FIG. 2.—DIAGRAM OF CAR, SHOWING LOCATION OF LAMPS, ETC.

the effect of which is noticed in the sudden increase in the intensity as that seat is reached.

Experience has shown that the curve of distribution depends much upon the nature of the glassware, so that, considering that this curve represents the performance of the arcs with only a single glass bowl-shaped enclosing globe, the distribution could be much improved by the addition of a suitable reflector.

A set of readings was taken directly under lamp No. 2, which gives an idea of the maximum intensity in the aisle of the car. However, it was thought to be of little value to secure a curve down the aisle, so that was omitted.

Turning our attention now to the curve representing the performance of the Pintsch gas system under commercial conditions in a standard type mahogany car, we see that the distribution is remarkable for uniformity. The specific readings were easily obtained and were very uniform, so that only average values are given as shown by the curve; but, as before stated concerning the arcs, these values are the average of six readings.

The general average illumination for the Pintsch gas system with units approximating 180 cp in a car was found to be about .75 foot-candle, while that of the arc is about 2½ times greater for approximately 600 cp of units.

A very interesting feature of this investigation was found in the effect of the color of the car upon the intensity. A third car—combination smoker-baggage—lighted with a standard

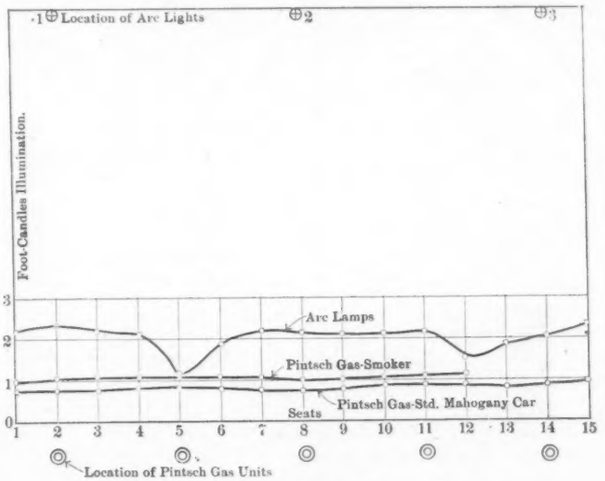


FIG. 3.—AVERAGE DISTRIBUTION OF ILLUMINATION.

equipment of Pintsch gas under the same conditions as the previous car, was tested in the same manner. The car was painted a very light gray and had cane seats. Readings directly under a Pintsch unit in the mahogany car gave an average of .98 foot-candle as compared with a reading of 1.12 foot-candles in the light-colored car.

The general character of the distribution curves is much the same, the light-colored car showing about 25 per cent greater effective illumination for an equal expenditure of energy than did the standard mahogany car.

A mail car is at present being equipped with the arc light system for combined axle dynamo and storage on a severe run out of Chicago and will be placed under rigid tests within the next 30 days. This run requires the car to be in use at least four hours per day in the terminal yards, and with the present gas system is has been the custom to gas the car once for the yard duty, and again before it starts on the trip.

Electrostatic Telephone.

In an article in *Comptes Rendus* for May 27, Mr. H. Abraham describes a modification of the "speaking condenser" of Argyopoulos and Deprez, and calls it an electrostatic telephone. The receiver is a piece of aluminum foil mounted on a sheet of gauze. An insulated metallic disk is brought as near to the aluminum foil as possible, and this "condenser" is charged to a difference of potential of 1000 volts. Under these circumstances the instrument is very sensitive to changes of voltage, and gives a sound when an ordinary telephone ear-flange is attached to it. An alternating potential difference of 0.003 volt is about the smallest that will produce an audible note, but the sensitiveness may be increased by transforming the incoming current or by resonance. This, however, is limited by the circumstance that the primary must be shunted on the line, and the square root of the ratio of capacities governs the limit. In any case, it is certain that in its present form the electrostatic telephone cannot aspire to a rivalry with the electromagnetic telephone.

Niagara Meeting of the A. I. E. E.

Following are further abstracts of papers read at the recent annual convention of the American Institute of Electrical Engineers held at Niagara Falls.

COMMUTATING-POLE RAILWAY MOTORS.

A paper by Mr. E. H. Anderson discussed the various possibilities that reside in the use of commutating poles with direct-current railway motors. Since, when commutating poles are used, the commutation is automatically taken care of for variations in speed in current, it is possible to change the voltage impressed on the motor through quite a range without sparking. The only limitations in raising the voltage are, first, the armature speed and the strength of the binding wire; second, the voltage between bars, and third, the insulation of the turns. According to present practice, before being connected to the armature winding, the commutators of railway motors are tested from bar to bar with about 500 volts so that the actual jumping of current from bar to bar on a clean commutator would not occur at less than 500 volts per segment. An ordinary commutator of 111 segments and four poles would, under these conditions, be suitable for 1300 volts between brushes. It is noteworthy, however, that the actual jumping of the current across the side of the micas of a clean commutator is not the limiting condition. The real limiting condition is the voltage per bar which will maintain an arc already established. If the average volts between segments in commutating-pole motors be assumed as 24, and the number of commutator bars per inch of circumference be taken as 5, it is possible to construct a 40-hp motor for 850 volts by using a 9-in. commutator, or a 250-hp motor for 1700 volts by using an 18-in. commutator. These values relate to four-pole motors. On 1200 volts a commutating-pole motor commutates decidedly better than an ordinary design of motor on 600 volts. The 1200-volt motor requires proportionately more insulation than the present 600-volt motor. This extra insulation requires more diameter and greater external dimensions.

There are several ways of making use of voltages higher than are now employed. The most prominent of these are the following: Combination city and interurban service, the former at 600 volts and the latter at 1200 volts. The motors would be wound and insulated for 1200 volts. Two motors would be connected in multiple and the two groups of a four-motor equipment would be handled in series and in parallel. A second way would be a combined city, suburban and interurban service, the two former being at 600 volts and the latter at 1200 volts. In this case the motors would be wound for 600 volts with a relatively low armature speed, but should be insulated for 1200 volts. On a 600-volt trolley two motors would be connected in multiple and the two groups would be handled in series and in parallel. On a 1200-volt trolley the two motors would be connected in series and the two groups of a four-motor equipment would be handled in series in parallel. The armature speed and the commutating features should be so designed that if one pair of wheels slips and a motor has 1200 volts across its terminals, its armature speed will be reasonable and the commutation good.

SINGLE-PHASE VERSUS THREE-PHASE GENERATION FOR SINGLE-PHASE RAILWAYS.

As an introduction to the discussion of single-phase and three-phase generation for single-phase railways, a paper was read by Mr. A. H. Armstrong presenting the advantages and disadvantages of each. From the viewpoint of simplicity the single-phase generation possesses considerable advantage, but it entails certain greater cost and lower efficiency. Advantages result from the use of a secondary single-phase distribution obtained from a three-phase source. The author discussed the following combinations of three-phase to single-phase connections: (1) Three-phase generation and primary distribution to motor-generator sets feeding into the single-phase secondary distribution. (2) Three-phase generators operating on alternating-current railway load on one leg, thus calling for both primary and secondary single-phase distribution. (3) Three-phase generation and primary distribution to sub-station, feeding successive trolley sections with separate phases. (4) Two-phase generation, the generating station being located in the center of the system and feeding one phase each way. (5) Three-phase generation and primary distribution to transformer sub-stations connected three-phase to two-phase and feeding the secondary distribution circuits in such a manner that adjacent sub-stations feed like phases into a common trolley section.

The matter of the proper selection of the generating apparatus for single-phase roads seems to be closely connected with problems of a commercial character relating to a possible future load requiring a three-phase input. From a purely engineering standpoint, and considered from the point of view of the railway load only, the single-phase system of generation and distribution is to be recommended. The possible installation of generators having a frequency lower than 25 cycles would help this decision, owing to the unfitness of such a low frequency for general power distribution work.

Of the several methods of single-phase combinations proposed, the motor-generator set best protects the three-phase distribution system where energy is purchased from foreign distributing systems, and such a method presents many advantages which may outweigh its increased first cost. Where the railway company finds it expedient to generate and distribute energy from its own three-phase generators, the use of a single leg for the railway load (3) or the installation of three-phase-two-phase transformer sub-stations (5)—both seem to offer advantages justifying their recommendation and the choice between the two may perhaps be left to the needs of local requirements.

TWENTY-FIVE VERSUS 15-CYCLES FOR HEAVY RAILWAY WORK.

A paper by Mr. A. H. Armstrong discussed the relative advantages and disadvantages of the present standard frequency of 25 cycles and the proposed lower frequency of 15 cycles. In comparing the weight of direct-current and alternating-current motors for various frequencies, he stated that a 25-cycle motor weighs 50 per cent more than a 15-cycle motor, 30 per cent more than a direct-current motor on a one-hour rating, while, on the continuous capacity rating, a 25-cycle motor weighs 25 per cent more and a 15-cycle motor 20 per cent more than a direct-current motor. For railway work, the less weight of a 15-cycle motor in comparison with a 25-cycle machine is partly offset by an increase of 30 per cent in the weight of the step-down transformer on the car. Thus, there is no material reduction in the weight of the complete alternating-current motor and control equipment. A 15-cycle series motor commutaties much better than a 25-cycle motor of the same type, but not so well as a direct-current motor. It is noteworthy, however, that recent improvements in alternating-current motor design have resulted in the production of a single-phase motor which compares very favorably in commutation with any of the standard direct-current railway motors now in operation, although inferior in this respect to the commutating-pole type of direct-current railway motor. In fact, the commutation of the single-phase motor has been so improved and the commutation losses so reduced even with a frequency of 25 cycles as to make it unnecessary to adopt any additional expedients to eliminate commutator troubles. While certain capacities of 15-cycle turbo-generator units may be constructed fairly comparable with 25-cycle units, it is very probable that the adoption of 15 cycles or less would seriously handicap the standardization of a complete line of such units. Both step-up and step-down transformers are handicapped at 15 cycles by an approximate increase in cost 30 per cent over that of 25-cycle design. The great field for alternating-current motors of 150 horse-power capacity and smaller is on interurban lines acting as feeders to the surface, elevated and subway lines of large cities. The ability of such motors to run from the same generating and distributing systems without re-

quiring the introduction of frequency changer sets constitutes a strong argument in favor of continuing the present practice of using 25 cycles on such lines. Mr. Armstrong expressed the opinion that the problem of standardizing the frequency might well be left in abeyance until the coming of fuller knowledge of the operation of electric locomotives equipped with motors of different types, and that much stronger claims for recognition must be brought forth before the adoption of 15 cycles can be seriously considered.

The subject of 25 and 15 cycles for heavy railways was also discussed in a paper by Mr. N. W. Storer, who stated that railway electrification, if developed as every electrical engineer hopes it will be, will mean an undertaking of such magnitude as to make it practically independent of other electrical interests, so that if a frequency different from the standard now in use will be advantageous, it should be adopted. The output from a motor of a certain size will be increased by from 30 to 40 per cent by the use of 15 instead of 25 cycles. Thus, a certain 100-hp, 25-cycle motor operated at 113 horse-power at 15 cycles with a considerable decrease in temperature rise. This same motor with a larger number of turns in the field coil and run on 15 cycles carried a load of 135 horse-power with a rise in the temperature less than at a load of 100 horse-power at 25 cycles. A larger motor which carried a load of 255 horse-power with a certain temperature rise, was found capable of carrying 300 horse-power at 15 cycles at about the same temperature rise, and with new field coils having more turns the motor could be made to carry at least 325 horse-power and probably 340 horse-power without an excessive temperature rise.

The greatest gain from the use of 15 cycles is to be found in heavy railroading where locomotives are employed. It has been found that in virtually all cases the weight of useful apparatus on the drivers, even with 15 cycles, is sufficient to give the necessary adhesion without adding dead weight. Moreover, the use of 15 cycles means that in practically all cases for the locomotive a smaller number of motors can be used than is possible with 25 cycles. An outline description was given of a locomotive which has been built to haul a 400-ton train both on heavy grades and at high speeds on level track. The locomotive is designed for 15 cycles, weighs approximately 140 tons and has four motors, each with a nominal rating of 500 horse-power. With a 400-ton train behind it, this locomotive would thus have to handle a total of 540 tons. A 25-cycle locomotive built to handle a 400-ton train at the same speed and on the same grades would require six motors of approximately the same dimensions, and the extra two motors, together with the extra weight of mechanical parts would bring the total weight of the locomotive up to approximately 185 tons. The total weight of train would thus be 585 tons, or an increase of about 8 per cent. The capacity of these motors would be in the neighborhood of 375 horse-power, which would be just about sufficient to handle the extra weight. It must be seen at once that the motors for this locomotive would cost 50 per cent more and the mechanical parts also considerably more. The only parts of the equipment which would cost less would be the transformer and preventive coils, and the control equipment would be enough more expensive to counterbalance this.

The locomotive is of the articulated type, each half of which has two pairs of drivers and a four-wheel truck similar to the standard American type of steam locomotive, the two halves being coupled back to back. The drivers are 72 in. in diameter with 7 ft. 6 in. between centers of axles. On each axle is mounted a gearless motor having a nominal rating of 500 horse-power and a continuous capacity with forced ventilation of about 375 horse-power. The motors, weighing approximately 19,500 lbs., are spring-supported, mounted, and connected to the drivers in exactly the same way as the motors on the single-phase locomotive for the New York, New Haven & Hartford Railroad. The frame of the locomotive is of the standard steam-locomotive type placed outside of the wheels. It is of cast-steel connected at the front and rear and at three places between the ends by heavy cast-steel girders. The truck, which is of the standard steam-locomotive pattern, has 36-in. wheels, with a wheel-base of 6 ft. 2 in.

The electrical and other equipment in the cab is mounted on a raised platform which is about 2 ft. above the floor-line and occupies the middle of the cab, allowing for a passageway on either side. There are numerous windows along the sides of the cab which afford excellent light for the inspection of the apparatus. The equipment is extremely simple and accessible. The main transformer, which is designed for 11,000 volts, is mounted above the trucks with the top just below the platform in the cab. Directly above the transformer is located the electropneumatic switch-group to which the various taps in the transformer are carried. Back of the switch-group are the preventive coils used in passing from step to step on the transformer, and from these preventive coils runs a single lead to the reverser switch-group, which is placed directly above the main motor. On this raised platform are also placed the motor-driven air-compressor, the motor-driven blower for furnishing air for ventilation of the motors and transformer, and the high-pressure air reservoirs. Suspended from the structural work between the platform and the Z-bars in the roof of the cab are the oil circuit breaker in the high-tension circuit leading to the transformer, the small switches used in connection with the auxiliary motors, and the 20-volt battery, which is used for operating the valve-magnets in the controller. The high-tension current is collected from the overhead wire by the standard type of pantagraph trolley. It will be noted that on account of the large drivers and the comparatively high position of the apparatus in the cab the center of gravity of the locomotive is higher than usual in electric locomotives. The riding qualities of the locomotive are exceptionally good. The weight of the locomotive, as stated, is 140 tons, there being 50,000 lbs. on each driving axle and 40,000 lbs. on each truck.

From 15 to 20 roads have been put in commercial operation with single-phase current at 25 cycles, and it has been proved beyond doubt that the single-phase motor is a thoroughly practical and commercial machine. At the same time, as was anticipated, experience goes to show that there are certain advantages to be gained by the use of a lower frequency.

Electrical engineers have an enormous responsibility in deciding upon matters of detail, such as frequency, which will have an effect that will far outlast any one who has a voice in the matter; and it certainly behooves electrical engineers to consider carefully before recommending the continuance of the present standard frequency of 25 cycles, where it imposes such a handicap on the capacity of the transportation systems.

WINDINGS FOR INDUCTION MOTORS.

An article by Prof. Comfort A. Adams and Messrs. W. K. Cabot and G. Irving, Jr., discussed the advantageous features of fractional pitch windings for induction motors. From both theoretical and experimental observations the authors conclude that the fractional pitch winding in comparison with the winding having 100 per cent pitch is advantageous in that it allows a reduction of the several components of the leakage reactance; a reduction of the over-all length of the motor and in some cases a considerable gain in the convenience of winding as well as a saving in space. It represents, however, a decrease in the exciting reactance, that is, a higher density in all parts of the magnetic circuit and a higher exciting current for the same voltage. It is to be noted that except for the reduction in endwise length over the windings, the effect of using a fractional pitch is the same as that produced by reducing the number of active conductors. Although the latter method is in many cases the more efficient from the standpoint of operation, the former is frequently more convenient from the standpoint of the manufacturer, even when the saving in endwise length is not a controlling factor.

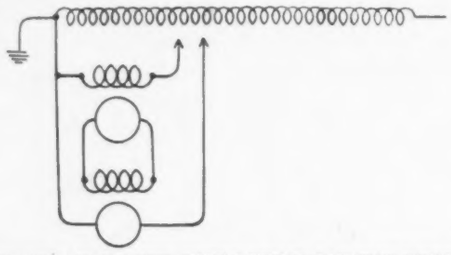
REGENERATION WITH SINGLE-PHASE RAILWAY MOTORS.

A paper by Mr. William Cooper described a method of using single-phase railway motors to restore energy to the generating

system. One of the motors of the equipment is used as an exciter for the others. By providing the auto-transformer with suitable voltage outputs the value of the field current of the exciter is varied through a wide range. In this respect the conditions are very much more favorable than in the case of the direct-current motor, in which the only variations that can possibly be made are in the series parallel combinations of the motors which are being used as generators. The arrangement of the motors and their connections is shown in the accompanying diagram.

Assume a car or locomotive upon which the motors are mounted to be in motion, the armatures turning at a corresponding speed. If the field circuit of the first machine be connected to the transformer, an alternating electromotive force will be generated by its armature, the value of which will be directly proportional to the speed. If the field circuit of the other motor be connected to the exciter armature, an alternating current will pass through it, and the second armature will in turn generate an alternating electromotive force the value of which varies about as the square of the speed—the excitation of the first machine remaining constant.

The electromotive force generated by the second armature will bear a very close time-phase relation with the electromotive force of the transformer, for the reason that the current in the field circuit connected to the transformer lags approximately 90 time-degrees behind the e. m. f., as does the current



REGENERATION WITH SINGLE-PHASE RAILWAY MOTORS.

in the field-circuit of the second machine. This combination throws the generated electromotive force of the second machine approximately 180 time-degrees back of the transformer electromotive force, or by reversing the connections in the same time-phase relation.

One other point that is worthy of note in connection with the operation of this system is the absolute safety and stability of the combination. While the machines being operated as generators are normally series machines, it will be noted that no one of the armatures is connected in series with its own field coils, and under no condition can there be any surging or building up of load. In case of momentary interruption of the supply circuit, the circuit again being restored, the system will again operate exactly as before the interruption, there being no surging or violent action of the machines.

The system of regenerating has been used in testing locomotives to give a dead-load condition under a wide range of speed. Numerous stand-tests have also been made, so that the operation of the motors under the conditions is well established and there is no doubt about the scheme doing all that is claimed for it.

HIGH-TENSION LINE CONSTRUCTION.

In a paper read by Mr. Harold W. Buck, the author gave an account of some new methods in high-tension line construction, some of which were applied in the construction of the Canadian Niagara Power Company's transmission line described in our issue of June 29, Mr. Buck being electrical engineer of this company. The method of line construction described in the paper is stated to have been developed by the writer and Mr. E. M. Hewlett.

According to this method, each span is dead-ended at each support through a series of insulating units which may be plain disks connected together with steel links. The various spans are then electrically connected by jumpers hung below the insulators. The insulators are directly attached to the cross-arms, eliminating all pins. The number of disks linked together in series depends upon the line voltage, the disks themselves being identical for all voltages.

Fig. 1 illustrates a design for a 100,000-volt two-circuit line which is soon to be constructed for transmitting 50,000 horsepower 165 miles. The spans in this case will range from 500 to 1000 ft. in length. Here the line is suspended below the cross-arm on most of the towers. The lines will be dead-ended with jumper connection as shown only at angles and on tangents at about every fifth tower. This dead-ending will be for the purpose of stopping any creeping of conductors on the line as a whole, to check the transmission of longitudinal waves along the conductors due to wind, and on curves to take the

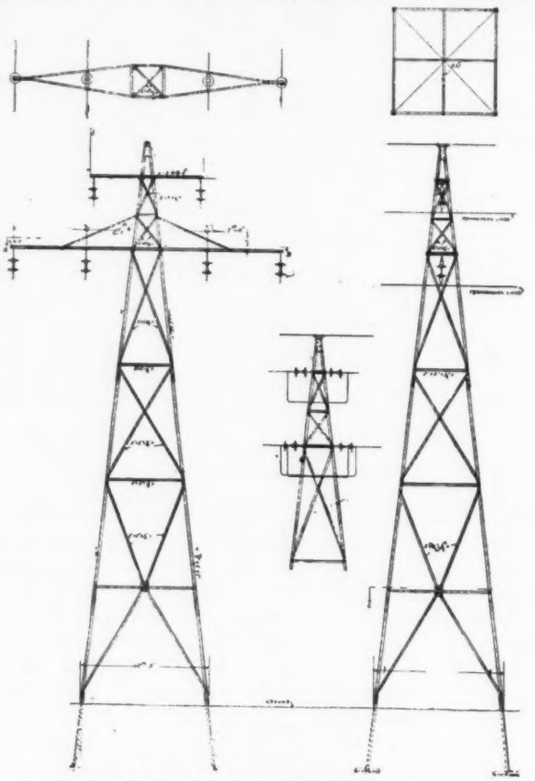


FIG. 1.—100,000-VOLT TWO-CIRCUIT TRANSMISSION LINE.

side stress of the conductor due to change in direction. In this installation the lines will not be triangulated, but at suitable intervals along the lines the conductors will be transposed so as to balance up effects of mutual, static and magnetic induction. Special cross-arms will be installed at transposition towers.

Fig. 2 illustrates another design for a two-circuit line which it to be built for 80,000-volt operation. The spans in this case will range from 300 to 400 ft. and the conductors will have an approximate triangular relation. The conductors will be suspended by a series of insulators from the cross-arms as in Fig. 2 with occasional rigid attachment, for the reasons given above.

Fig. 3 shows a method of assembly of the insulators for suspension under a cross-arm. Fig. 4 illustrates a method of assembly where the spans are dead-ended at the cross-arm with jumper connection.

The advantages of this construction, which might be termed "series unit insulation," over the pin and petticoat type are summarized as follows:

1. With the standard type of pin insulator now used the difficulties of construction increase very rapidly at the higher voltages. The cost of insulator for a given margin of safety increases for voltages above 60,000 nearly as the cube of the increase in voltage. Either large petticoat diameters must be used, or very high insulators with many petticoats. In either case the manufacture of the porcelain parts is a difficult and expensive matter, and with the long pin necessary the mechanic-

al stresses from the line on insulator, pin and cross-arm are objectionable. With the series unit system proposed, the cost of insulator progresses only in direct proportion to the increase of voltage, the only change being in the number of units in

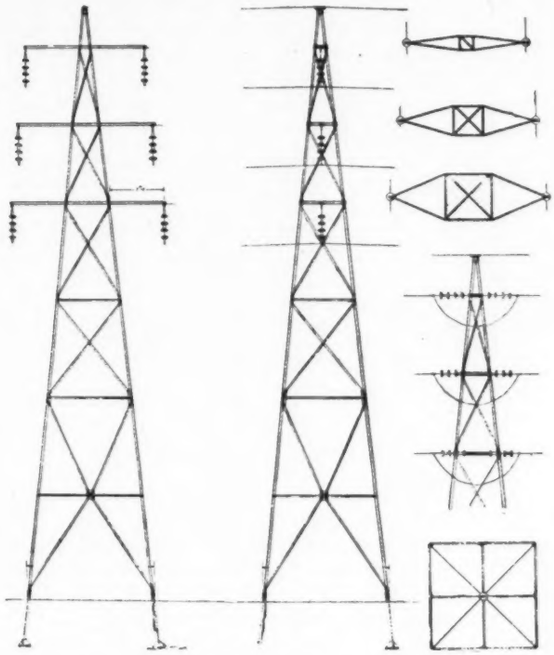


FIG. 2.—80,000-VOLT TWO-CIRCUIT TRANSMISSION LINE.

series. There is practically no limit to the degree of insulation obtainable.

2. One of the most difficult elements of design in a transmission tower where long pins and petticoat insulators are used is to obtain a cross-arm which will resist the torsional stresses due to the leverage of the pin. With the pin entirely eliminated,

FIG. 3.—METHOD OF ASSEMBLING INSULATORS.

the stresses are directly applied to the cross-arm, which cheapens the construction of the tower.

3. In the arrangements where the insulating units are attached on either side of the cross-arm, taking the full tension in the line with jumper connection between spans, the insulation can be increased indefinitely by adding disks in series without increasing the space occupied on the tower.

4. Where each span is dead-ended, all faces of the insulating units are exposed to the cleansing action of the rain, so that dirt cannot accumulate thereon. This arrangement also prevents the dripping water from forming electrical communication between units as occurs from one petticoat to another in the pin type of insulator.

5. A standard insulating unit can be adopted for all voltages, the only variation being in the number linked in series. This simplifies the manufacturing problem.

6. If any insulating unit becomes damaged or completely shattered the insulation of the remainder is not affected. The damaged unit can be replaced without the necessity of renewing the whole.

7. If a tower is directly struck by lightning the cross-arms will be likely to take the discharge, since they are above the lines, whereas in the pin type of insulator the line is usually the highest point.

8. In long-span installations where the conductor at each end of the span is tied fast to an insulator mounted on a pin, experience has shown that crystallization is apt to take place in the conductor at the tie, due to its rigidity at that point and the vibrations in the span. This frequently results in breakage of the conductor. The flexible connection between conductor and cross-arm afforded by the series of insulators should reduce this tendency to crystallization, and should therefore permit spans of any length to be used without further precautions against this action.

Fears may be expressed that with the conductor suspended

FIG. 4.—DEAD-END INSULATOR ARRANGEMENT.

under the cross-arm serious swinging to and fro might take place. From numerous observations it is believed that no such swinging will occur. Long aerial spans under wind pressure take a permanent and steady deflection throughout the span proportional to the average wind velocity along the span, and no indications have been observed of long spans responding to so-called gusts. The towers illustrated are designed so that the conductor can safely be deflected by the wind about 60 deg. on either side of the neutral position.

Insulators of a great many forms have been built and tested, but the one which gives the best results electrically and mechanically is the "link-type" developed by Mr. Hewlett and having the grooved or fish-tail periphery. Four of these in series are sufficient for 100,000-volt operation with a liberal factor of safety.

A very important element in this construction is of course the methods of fastening the insulating units together and attaching them to the line and cross-arms. This can be accomplished in many ways and several methods have already been worked out, but these details are beyond the scope of this paper. Further experience in practical line construction and operation under this system will demonstrate the best methods of installation and attachment.

The Use of Special Instruments in Telephone Service.

At the recent convention of the Association of Railway Telegraph Superintendents at Atlantic City, N. J., Mr. Robert E. Chetwood, Jr., of the American Telephone & Telegraph Company, read an interesting and instructive paper under the above-named title.

Mr. Chetwood stated that he believed the range of commercial telephony will be extended mostly through improvements in the line circuits themselves rather than by the use of more powerful transmitters or more sensitive receivers. In the case of a circuit several hundred miles long only a small percentage of the current placed upon the circuit by the transmitter reaches the receiver, the difference representing the transmission losses in the line and in the apparatus associated with the line.

There are four factors which determine the transmission efficiency, or attenuation in a circuit, namely resistance, inductance, mutual electrostatic capacity; shunt resistance, the shunt resistance being the mutual, or the wire-to-wire insulation resistance of the circuit. A definite relation exists between these factors which can be expressed mathematically. The attenuation can be increased by decreasing the resistance, that

is, increasing the size of the line wire. This is, however, a most expensive method of improving transmission. The second method is to increase the inductance. Improving transmission in this way is known as loading a circuit and consists of installing in a circuit, at certain definite intervals, coils of low ohmic resistance and high inductance, the coils themselves being known as loading coils. But loading has also its limitations. In the first place, a loaded circuit requires a much higher insulation resistance than a non-loaded circuit and also the circuit must be of a certain minimum length before the value of the loading becomes apparent in increased transmission. It is a fairly expensive method of improving line transmission, as the coils are expensive to make and on open wire circuits must of course be protected from lightning. The greatest success in loading so far obtained has been in connection with cable circuits, where the insulation can easily be maintained at a high figure, and on open wire circuits of a gauge of wire smaller than No. 8. The possibilities of improving transmission by loading are extremely promising; in fact, much has been accomplished already in loading No. 12 wire circuits and also in loading cable circuits. The loading of open wire circuits larger than No. 12 has not, however, been entirely successful, but promises to be so in the near future.

A third method of bettering transmission is to decrease the mutual electrostatic capacity of the circuit—that is, make the current as small as is possible. The capacity of a circuit depends on the diameter of the wires composing the circuits and on the separation between the wires. The larger the diameter of the wires the greater the capacity, and the greater the separation between the wires the less the mutual electrostatic capacity. This is one of the reasons why part of the gain in transmission which should result from the use of wires of low resistance is lost, due to the increase in capacity, the capacity increasing as the line wires increase in size. As the capacity decreases as the separation between the wires increases, it is obvious that transmission can be improved by placing the wires further apart. This of course means a fewer number of circuits per pole line and consequently means a large increase in the cost of circuits to handle a given volume of business. Again, the improvement in transmission due to a separation between the wires of a circuit of 24 inches instead of 12 inches is so slight as to make it a method not to be seriously considered.

The fourth and last method of improving transmission is by increasing the shunt resistance of a circuit, or, in other words, increasing the insulation resistance. Inefficient line maintenance is the cause of poor transmission more often and to a greater extent than is realized. Every slight leak on a circuit provides a shunt path to keep the transmitter current from reaching the receiver at the distant end of the circuit. If the points of low insulation on the wires of a circuit do not coincide and are not of approximately the same resistance, then the circuit becomes unbalanced and noisy, which, of course, means unsatisfactory transmission. Of two circuits composed of the same size line wires, the one which is perfectly quiet will give better and more satisfactory transmission, than the one that is slightly noisy due to leakage caused by broken insulators, trees, etc., even though a more powerful transmitter is used on the second circuit than on the first.

In commercial telephone work, he said, any wire that does not show an insulation of at least 10 megohms per mile, on a clear day, is considered a faulty wire.

In concluding, the author stated that he could conceive of but one or two situations that will allow of the use of powerful transmitters, and the peculiar conditions which theoretically will allow of the use of such instruments have not been met with in practice. In each case where it at first seemed as though the situation demanded more powerful transmitters than the standard transmitters, it has been found that by improving line maintenance and operating conditions, by increasing slightly the amount of current furnished to standard transmitters or by the use of telephone repeaters, the necessity for powerful transmission has been obviated.

New Telephone Patents.

PORTABLE APPARATUS FOR THE DEAF.

The telephone is continually becoming more useful as a means of enabling persons to hear who are afflicted with certain kinds of deafness. Of course, one of the serious problems is the production of a portable apparatus of sufficient range and sensitiveness. Two recent patents represent attempts at solutions. One describes the microphone transmitter shown at the right in Fig. 1. The carbon granules are held against the

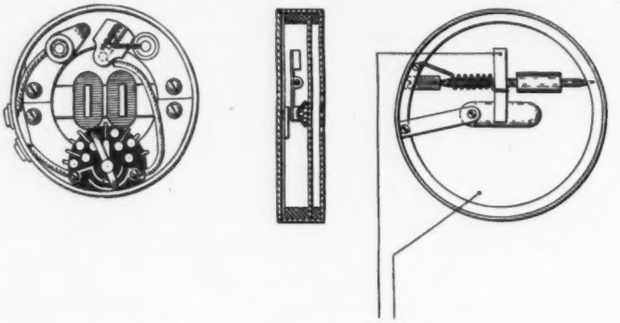


FIG. 1.—HOLLAND MICROPHONE.

diaphragm by a cup of metal upon a pivoted support. The motion of the cup is limited so that the granules cannot be spilled out. The cup support carries a counter-balance adjusted so that the normal contact of the granules is light and sensitive. This is the invention of N. H. Holland, of Chicago.

The second patent covers an adjustable receiver invented by K. M. Turner, of New York City, and assigned to the General Acoustic Company. A number of points of the receiver winding are brought out to points of a switch, so that at will any number of turns of the coils may be used. The instrument is of course adjusted for the particular use at any moment.

SWITCHBOARD CIRCUITS.

H. G. Webster, of Chicago, has patented two circuit systems for common-battery switchboards, the patents being assigned to W. J. Kellogg. One is a three-point jack system in which the control of the line signal lies in a cut-off relay differentially wound. In making a call the line relay current traverses the line and both windings of the cut-off relay. This latter is not energized. When a plug is inserted in a jack, however, the balance is destroyed, as current is led from one of its contacts through the jack to a point of the cut-off relay connected between the windings. A further feature is that a two-part plug and cord serve to make proper connection with the three-point jack.

The second patent describes a two-wire scheme designed to avoid annoying clicks. The circuit is so arranged that the connection between the line and battery is never severed. A shunt is arranged across the cut-off contacts so as not to interfere with the operation and yet to maintain a battery circuit.

MULTIPLEX SYSTEM.

The use of superimposed alternating currents has long been suggested as a means to multiplex telephony. The system depends upon the use of frequencies above the range of the human ear, and the superimposing upon these of transmitter currents. Maurice Leblanc, of Paris, France, one of the joint inventors of earlier patents for such a system, has obtained a recent patent. In the system now described, there are provided two main line wires. For each simultaneous transmission there must be a pair of branches, one at each end, and a generator branch near the middle. All of these branches are tuned to resonate at the frequency of the generator of the middle branch. The end branches contain receivers, transmitters and coils. The transmitter superimposes its current upon the alternating current. This alternating current is excluded from all branches except those tuned to receive it, and thus the transmission occurs to the desired distant branch only.

THERMAL LINE RELAY.

Relays for controlling the auxiliary circuits of common-battery switchboard circuits have almost always been patterned in some degree after the telegraph relay. The early relays were almost copies of the telegraph relay, while later relays have progressed far from the prototype. An entirely different sort of relay is used by Messrs. F. B. Cook and J. G. Nolen, of Chicago, in their telephone exchange system recently patented. Their relay is shown in Fig. 2. The line current, passing

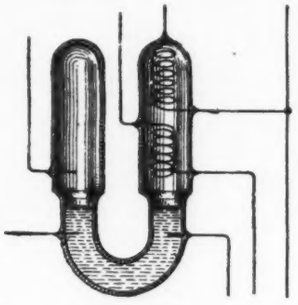


FIG. 2.—COOK AND NOLEN THERMAL RELAY.

through the two practically non-inductive windings, produces sufficient heat to expand the gas in the chamber. This by its unbalanced pressure displaces the conducting liquid sufficiently to close or open, according to arrangement, the auxiliary circuits.

JACK STRIP.

When the metal plate jack strip superseded the all-rubber strip, the metal, as was natural, took on as near as practical the general form of the rubber. This probably accounts for the solid metal lugs usually riveted upon the ends of the metal plate. H. P. Hibbard, of Chicago, has departed from this arrangement, and forms up his lugs out of the ends of the plate. A long tongue is left upon the stamping, which, after being bent first at right angles to the plate, by say a left-hand bend, is then formed into a hollow tube by a series of three right-hand right-angle bends equally spaced along the length of the tongue. The result is a square section hollow lug integral with and meeting the foundation plate at one of its edges, and extending beyond the main body of the base plate. Mr. Hibbard's patent is assigned to the Western Electric Company.

SENDER FOR AUTOMATICS.

Another patent assigned to this company covers a sender switch for automatic switchboards, with which, after a call is once set and started, it is impossible to mix up the selection by tampering with the lever. The lever is secured to its shaft through a ratchet which is so arranged as to release the instant the mechanism starts backward in the process of sending in a call, and it cannot be recaught until all parts reach zero position. When it is desired to set a call, the lever is swung to the desired number. The lever is at this time locked, and carries with it its shaft. The first movement forward breaks one connection in the sending circuit and makes a second. The first is controlled by a cam moving with the lever, and the second by a lug moving with the escape wheel and carried forward with the shaft. As soon as the lever is released, the cam and shaft return to normal and close the break in the circuit. The ratchet then begins to step back home, where it stops, due to the operating circuit of its magnet being broken by the lug.

WALL SET.

Mr. W. Kaisling, of Chicago, has obtained a patent for a wall set, this being assigned to the Stromberg-Carlson Company. All parts save the bell are mounted upon the back-board and the shelf and box swing down to uncover them. Part of the box side is secured to the back-board, this being cut away from the box through the line of the switch hook. When the box swings out, this piece of course is left behind, the hook switch not being disturbed. Another feature is a long bolt for securing the box in the closed position. This screw passes through the box front and through guides within the box, in a manner such that it always registers automatically with its nut set in the back-board.

WIRELESS APPARATUS.

The requirements of wireless telephony are so much more exacting than for wireless telegraphy that at first view the proposition looks hopeless. However, apparently a step has been made in the right direction by F. J. McCarty in his apparatus shown in Fig. 3. At the left of the sound channel is a telephone transmitter, while at the right is the primary side vibrator of the induction coil. This vibrator consists of a sensitive diaphragm arranged to vibrate under influences of the voice, to make and break the primary circuit. It will be seen that the frequency of the sparks will correspond to that of the voice currents sent out from the transmitter and superimposed upon the spark coil currents by a tertiary winding. This ter-

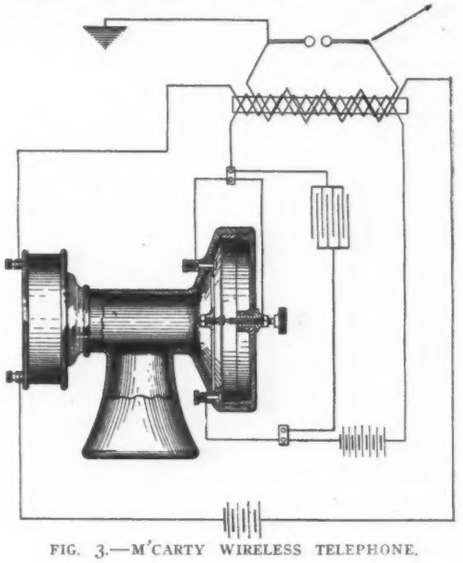


FIG. 3.—M'CARTY WIRELESS TELEPHONE.

tiary is wound in a layer between the primary and secondary and has a blanketing effect increasing as its resistance lowers. It is the inventor's idea that the transmitter effect is introduced in this manner.

RING-OFF SYSTEM.

With grounded lines and a bridged clearing-out drop there is found, at times, difficulty in operating the drop. To overcome the difficulty L. B. Nieman, of Staplehurst, Neb., has proposed an auxiliary low-resistance drop bridged off to ground. Each station has a key to ground one terminal of its generator when desired, so that the drop may be thrown.

LETTER TO THE EDITORS.

Wireless Transmission of Energy.

To the Editors of Electrical World:

SIRS:—The writer has read with a good deal of interest the reprint in your issue of June 29, 1907, of Mr. Nikola Tesla's recent letter to the *New York Times*.

In this letter it is to be observed that Mr. Tesla is still harping on his system for the "wireless transmission of energy" and proclaiming it as a discovery deserving to rank with that of Copernicus. It occurs to the writer, however, that we have been hearing about this system (mostly from Mr. Tesla himself) for a number of years, but apparently the "system" has never progressed beyond the *paper* stage.

At the exposition in St. Louis in 1904, a very substantial purse was offered to anyone who would succeed in transmitting even one-tenth of a horse-power a few hundred feet without

wires, but there were no successful contestants. May I enquire why Mr. Tesla did not wade in boldly and carry off the prize? And if he will enlighten us as to how *many* air ships he has *in operation*, deriving their power from water-falls, it will be greatly appreciated.

No one appreciates Mr. Tesla's achievements in the electrical field more than the writer, but it certainly seems that it is incumbent upon the inventor to show why his "system" of wireless transmission has failed to materialize, practically.

WASHINGTON, D. C. J. HANSON BOYDEN.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Alloy Steel Sheets for Transformers.—R. POHL.—An article on the use of special alloy-steel sheets for transformer construction. The characteristic features of this alloy—which is composed, according to Kapp, of 96.2 per cent iron, 3.4 silicon, 0.32 manganese, 0.03 carbon, 0.04 sulphur and 0.01 phosphorus, so that it is a silicon steel very low in carbon, sulphur and phosphorus—are an extraordinarily high resistivity (so that the eddy current losses are reduced) and a low coefficient of hysteresis. The total losses at 50 periods are about half the losses in ordinary dynamo-iron sheets at the same saturation. The permeability is considerably increased up to saturation of

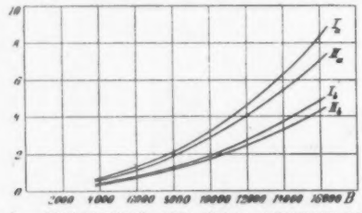


FIG. 1.—HYSTERESIS AND EDDY CURRENT LOSSES.

about 10,000, but then decreases rapidly. The only disadvantage of these alloy-steel sheets is their high price, which is two and a half times that of ordinary dynamo-iron sheets. The author shows in detail that, nevertheless, this alloy may find useful application in the construction of transformers. The author predetermines the design of a 50-kw, single-phase transformer for a frequency of 50. First for ordinary transformer iron sheets and second for special alloy-steel sheets. The characteristic curves are given in Figs. 1 and 2. Fig. 1 gives the total loss for one kg., that is, the sum of hysteresis and eddy current losses in watts per kg., while Fig. 2 gives the magnetization curve and permeability curve. Curve I_a in Fig. 1 refers

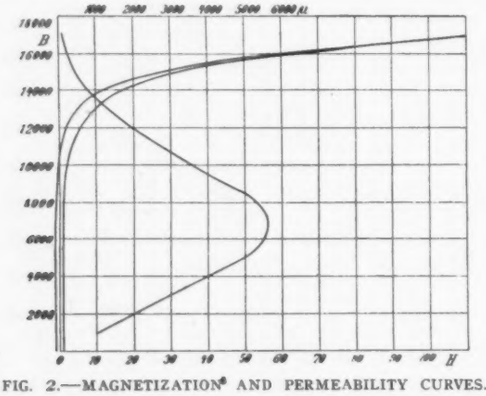


FIG. 2.—MAGNETIZATION AND PERMEABILITY CURVES.

to a thickness of the sheet of 0.5 mm and a frequency of 75 periods, curve I_b to a thickness of 0.5 mm and 50 periods, curve II_a to a thickness of 0.35 mm and 75 periods, curve II_b to a thickness of 0.35 mm and 50 periods. The author shows that by the use of these special alloy-steel sheets for transformers it is possible not only to increase the efficiency, but in spite of the high first cost the total cost of material and the weight of the transformer may be reduced if the special properties of the alloy are properly taken into account in the design. The chief change in the design is the reduction of the ratio of iron weight to copper weight from about 3 to about 2 and of a considerable increase of the thickness of the sheets of the flux density whereby the dimensions and the weights are essentially reduced. The use of alloy sheets is especially profitable for small transformers operating below the temperature limit, but the profit disappears for large and magnetically highly-saturated types. There is no profit either in the case of revolving dynamo-electric machinery. In order to make the alloy sheets applicable to the

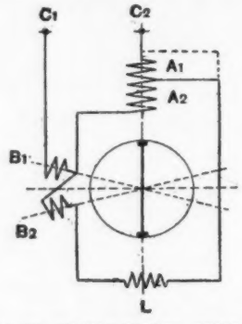


FIG. 3.—DIAGRAM OF SINGLE-PHASE MOTOR CONNECTIONS.

latter the cost of the alloy sheets should be further reduced.—*Elek. Zeit.*, June 13.

Compensated Single-Phase Motor.—T. LEHMANN.—Some notes on tests of a compensated single-phase motor without exciting brushes. The machine was a 75-hp, 50 cycle (or 60-hp, 25-cycle) traction motor. As shown in Fig. 3, the rotor has a bar winding with one turn per commutator section, while the stator winding, also of bars lying in half-closed slots, is divided into four branches A_1, A_2, B_1 and B_2. Of these, A_1 and A_2 occupy eight slots per pole, while B_1 and B_2 occupy two slots per pole, and are arranged side by side at equal angles on either side of the normal to the brush axis. The compensating circuit is shown as including B_2 and A_2, but might equally well have been connected, as shown by the dotted line, so as to include A_1, A_2 and B_2. The turns in B_1 and B_2 have to be chosen so as to give the necessary displacement of the compensating and exciting circuits relatively to the brush axis. In the present motor A_1 was made equal to A_2 and B_1 to B_2. L is an adjustable inductance. The tests were carried out at the lower frequency of 25, so as to reduce the compensating action of the short-circuit currents under the brushes to a minimum. The influence of the ohmic losses is also greater at the lower frequency, so that, as regards both compensation and efficiency, the conditions are more severe at 25 cycles than at 50 cycles. The results of the tests are given in diagrams and it is shown that the automatic compensation was complete between 300 and 400 r. p. m.; i. e., without in any way adjusting the inductance L, the power factor remained unity between these speeds. The motor, in fact, shows complete compensation at speeds well below synchronism, a result which is not attainable with the ordinary compensated repulsion motor having series exciting brushes as well as short-circuited brushes. With a constant supply current of 50 amperes, the power factor is unity between 280 and 400 revolutions, while with 100 amperes the zone of complete compensation is more limited and does not continue above 330 r. p. m. This is owing to the fact that, with the higher current, voltages of 450-500 volts are required for 330 to 400 revolutions, and this involves saturating the iron and the consequent increase in leakage. To overcome this diffi-

culty, it would, however, only be necessary to reduce the inductance L, and so increase the compensating current I_2 at the higher speeds. With a view to deciding how variations in the amount of the compensating current affect the power factor and the efficiency, a second similar motor was arranged as shown diagrammatically in Fig. 4. This arrangement possesses some advantages over Fig. 3 in that the whole stator winding is permanently connected to the supply circuit whether compensation is taking place or not. There were ten slots per pole of which 4 x 2 were occupied by A_1 and A_2 and by B. The axis of A_1 and A_2 were separated by four slots, so that there were two slots on either side of the brush axis. The short circuit and open-circuit characteristics of this motor were

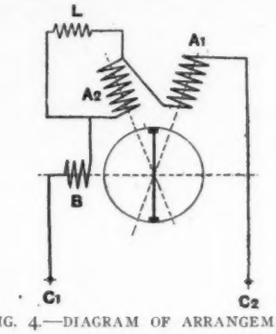


FIG. 4.—DIAGRAM OF ARRANGEMENT.

practically as in the other case. The maximum efficiency occurs at a little below synchronous speed and it falls to 75 per cent at half synchronism. Large air-gaps are quite permissible in these motors without detriment to their electrical qualities.—Lond. *Elec. Rev.*, June 14.

Commutation.—A. LIENARD.—The commutation of a direct-current dynamo is satisfactory only if the condition is fulfilled that $R\,T$ is larger than L, where T is the duration of commutation, L the self-induction of the short-circuited coil and R the contact resistance of the commutator segment with the brush in the position where the contact is the most extended one. To establish the above relation it is generally supposed that a brush has just the size of the collector segment and that consequently there is always one coil in the stage of commutation under each brush. The present author discusses the more general case where a brush covers several segments and gives the mathematical theory of this case.—*L'Eclairage Elec.*, June 15.

Separation of Iron Losses.—T. F. WALL.—In a former article the author had shown how to separate the iron losses in non-synchronous machines by the use of retardation curves. He now shows how to separate the losses without such curves and gives the results of experiments on a 5-hp motor. A method is then given whereby the momentum of inertia of the rotating parts may be found by means of the circle diagram. From this and a retardation curve, the friction loss is found for the same motor as was used in the first part, and a comparison of results is made.—Lond. *Elec.*, June 21.

Determination of Losses in Motors.—C. F. SMITH.—A paper read before the Manchester Section of the (British) Institution of Electrical Engineers summing up the various methods for the experimental determination of the losses in both direct-current and alternating-current motors.—Lond. *Elec. Rev.*, June 14.

Lamps and Lighting.

Two-Filament Lamp.—An illustrated description of an incandescent lamp made by a British company. As shown in Fig. 5, it contains two filaments of high and low candle-power respectively, which can be used separately, or the two in parallel; therefore the lamp will give three distinct candle-powers, and the current used is approximately in proportion to the light given. A 5/16-cp lamp will give 5, 16, or 21 candle-power at will, by simple rotation of the lamp. Any combination of candle-power can be made above 2½ candle-power. The lamp is made to fit any standard lamp-holder. There are three contacts at the top of the lamp, one being common to the two filaments, while the other two are connected to each of the two filaments respectively. The lamp can be twisted so that a connection is made to both the filaments at once, or the filaments can be used separately, thus giving a choice of three

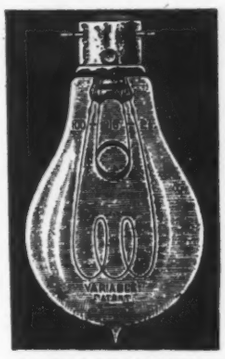


FIG. 5.—TWO-FILAMENT LAMP.

candle-powers. This will at times be found of advantage, and will tend to economy in current consumption.—Lond. *Elec.*, June 14.

Arc Lamps for Photographic Work.—An illustrated note on arc lamps made by a British company for photographic, copying and process work. In one type enclosed arcs are used, the lamps being of the non-focusing type, and an extra long arc is used as its light has a higher actinic value. With open-type arc lamps a parabolic reflector is employed so as to concentrate the light to a small surface.—Lond. *Elec. Eng'ing*, June 13.

Quartz Amalgam Lamp.—L. ARONS.—An article on improvements of his amalgam lamp whereby he has succeeded in obtaining a very rich line spectrum. He admits that the old cadmium-amalgam lamp has great disadvantages in comparison with the mercury lamp. Even when artificially cooled, the glass cracks after a short use. Since, however, Heraeus has succeeded in constructing vacuum tubes of quartz, we have at our disposal a material quite capable of withstanding the heat necessary for maintaining the mercury or amalgam arc in full strength. The best amalgam to use is one of lead and bismuth, corresponding to the formula Hg_3PbBi. On gradually increasing the current, the lines of mercury appear first and then those of lead and bismuth, but these frequently alternate and fluctuate. Küch has proposed to add zinc and cadmium in order to increase the ultra-violet spectrum. In this manner a very rich spectrum is obtained, in which the ultra-violet portion may contain as many as 18 mercury lines, as well as 8 due to lead, 8 to bismuth, 5 to cadmium, and 3 to zinc. The lamp will burn for hours at a stretch. Whether it can be turned to industrial use is not certain as yet, but quartz lamps containing pure mercury are already being manufactured for public lighting.—*Ann. der Physik*, No. 6; Lond. *Elec. Eng'ing*, June 20.

Mercury Arc.—J. POLAK.—The first part of an illustrated article on the mercury arc lamp and its technical applications. The author first discusses the physics of the mercury arc, dealing with the distribution of the energy in the arc, and the mechanism of electric conduction through the column. The two characteristic features of the mercury arc are, according to the author, ionization due to high temperature, especially at the cathode; and transmission of electricity, especially by means of "molions." The latter are neutral mercury molecules combined with an electron. The author then discusses in detail the drop of potential at different points of the column of the lamp. The paper is to be continued.—*Elek. Zeit.*, June 13.

Enclosed Arc Lamps.—W. WEDDING.—A translation in abstract of his recent German paper on the development and present status of enclosed arc lamps.—Lond. *Elec.*, June 21.

Searchlights.—J. I. HALL.—A second article illustrated by diagrams on improvements in the design of projectors.—Lond. *Elec. Rev.*, June 14.

Theatre Lighting—An illustrated description of the electric lighting plant of the Palace Theatre in London.—Lond. *Elec. Eng'ing*, June 13.

Fuse Pillars.—An illustrated description of the construction

of combined fuse pillars and arc lamp posts at Bradford.—Lond. *Elec. Eng'ing*, June 20.

Power.

Electromagnetic Variable Speed Gear.—A. P. Zanl.—A description of an electromagnetic device for varying the speed of a power shaft driven by a constant-speed prime mover. The arrangement will be understood from Fig. 6. The armature *a* is similar to the armature of an ordinary direct-current ma-

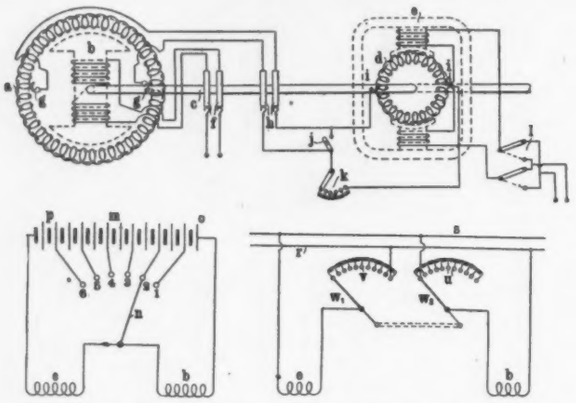


FIG. 6.—ELECTROMAGNETIC VARIABLE SPEED GEAR.

chine, and is mounted on the shaft of the prime mover. In electromagnetic relation to this armature is placed a field magnet, *b*, of any desired number of poles, this field magnet being fixed to the driving power shaft, *c*, and rotating with it. The power shaft also carries a second armature, *d*, which is fastened to it in any suitable manner, and rotates in electromagnetic relation to a second field magnet, *e*, which is not rotatable. The rotating field magnet, *b*, is provided with slip-rings, *f*, *f*, by which the exciting current is introduced, and the brushes, *g*, *g*, carried by the rotating magnet *b* and bearing on the commutator of the first-mentioned armature *a*, are also connected through slip-rings *h*, *h*, to the brushes, *i*, *i*, of the second armature *d*. In order to vary the speed at which the power shaft is driven in this arrangement, it is only necessary to vary the excitation of the fields *b* and *e*. According to one method shown in the lefthand lower diagram of Fig. 6 the fields *b* and *e* are excited by means of a battery, *m*, having a number of cells in series, and positive and negative plates being connected to an arc of separate terminals 1, 2, 3, 4, 5 and 6, adapted to make contact in turn with a key, *n*, connected between a pair of terminals one from each of the field magnets, *b* and *e;* the other terminals of the two field magnets are connected to positive and negative plates, *o*, *p*, at the two ends of the battery. It will be seen that by this arrangement by moving the key, *n*, over the arc of terminals the excitation of the field magnets may be varied simultaneously, the excitation of one of the field magnets being increased while that of the other is decreased and vice versa. In the arrangement shown in the right-hand lower diagram of Fig. 6 the energy for excitation of the fields is taken from mains, *r*, *s*, and in this case connected switches w_1, w_2, are used. These switches are adapted to pass over arcs of contacts, *v*, *u*, respectively, and the two fields are connected to these switches and to the mains, *r*, *s*. This arrangement, therefore, serves to control the excitation in the two fields simultaneously by means of a pair of connected rheostats formed by the switches, w_1, w_2, with their arcs of contacts, *r*, *u*, and their resistances. In order to start the power shaft, the field of the field magnet *b*, should be very weak, as the e. m. f. generated at the brushes of the armature, *a*, should be small, and only sufficient to circulate the necessary current in the armature, *d*, as there is no counter e. m. f. at starting. The torque exerted between the first magnet *b*, and the armature, *a*, and which is directly transmitted to the power shaft, *c*, is thus very small. In order to increase the total effective torque on the power shaft by starting, therefore, it is convenient to insert resistances, and this is done by means of the variable resistances, *k*, in series with the armature, *d*. It is thus possible to obtain a higher voltage between the brushes, *g*, *g*, of the first armature without exceeding a safe value of current. A useful torque is thus obtained between the armature, *a*, and field magnet *b*, on account of the increased strength of the field. The resistances, *k*, will be cut out when the speed comes up.—Lond. *Elec. Eng'ing.*, June 13.

Traction.

Electric Traction in Great Britain.—The annual list of British electric tramways giving statistical data on the equipment, etc., of 179 tramway systems of the United Kingdom. A second table gives statistical data on 16 electric railways and the third table gives data on 21 electric power companies.—*Supplement* to Lond. *Elec. Rev.*, June 21.

London Underground Railway.—An illustrated description of the Charing Cross, Euston & Hampstead Railway, which is the last link in the system of underground railways, forming the scheme originated by the late C. T. Yerkes. The equipment of the line is of the same general character as that of the previous tube railways. The third-rail system is used. The power is supplied by 11,000-volt, 33-period, three-phase currents and is changed to direct current in four rotary converter sub-stations. —Lond. *Elec. Eng'ing*, June 20.

Automobiles.—A. A. C. Swinton.—A paper read at the Engineering Conference of the (British) Institution of Civil Engineers in which the author reviews various systems of electrical transmission gear on motor vehicles.—Lond. *Eng'ing*, June 21.

Installations, Systems and Appliances.

Static Balancers.—C. C. Garrard.—The first part of an article on the use of static balancers on three-wire direct-current systems in order to balance the voltage between the outers and the neutrals. The static balancer really consists of a choke coil, the terminals of which are connected to two or more brushes bearing on slip rings connected to equally-spaced points round the armature of the dynamo. Between the slip rings, of course, an alternating e. m. f. is generated, but the strong choking action of the balancer prevents any large flow of alternating current out from the slip-rings. At a point midway between the terminals of the balancer the connection to the midwire of the direct-current network is made. A diagram illustrating the system is given in Fig. 7. *D* is the dynamo, shown dia-

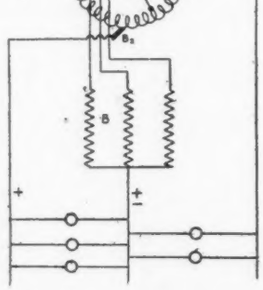


FIG. 7.—DIAGRAM OF STATIC BALANCER SYSTEM.

grammatically as a two-pole one. In addition to the commutator, the armature is provided with slip-rings. The balancer is shown as of three-phase construction, having three legs connected in star. The author then discusses the regulation of voltage of the dynamo with the static balancer and begins to discuss the design of such balancers.—Lond. *Elec. Rev.*, June 14.

Up-Keep Charges of Generators.—H. H. J. Burstall and J. S. Highfield.—A paper read at the Engineering Conference of the (British) Institution of Civil Engineers on the up-keep charges of large electric generating sets. The charges for the electric generators, steam engines and gas engines are separately

considered. The cost of maintenance is divided under two heads. The first section comprises charges which may vary with the capacity of the plant: *a* capital charges, including repair shops, tools, *b* wages and supervision, *c* painting and cleaning of engines, *d* insurance. The second class are the charges which may vary with the hours run or units generated and are materials and wages for renewal of parts (piston rings, packing, dynamo brushes, etc.).—Lond. *Eng'ing,* June 21.

Wires, Wiring and Conduits.

Corrosion of Lead-Covered Cables.—F. FERNIE.—An article in which the author discusses various causes of the corrosion and pitting of the lead sheathing of underground cables. The corrosion may be caused by purely chemical means. Thus soft water in the presence of air has a corrosive action on lead. The corrosion may also be due to electrolytic action. Some notes are given on the chemistry and electrochemistry of the subject.—Lond. *Elec. Eng'ing,* June 20.

Electrophysics and Magnetism.

Alpha Rays and the Periodic System of Elements.—A. VAN DER BROEK.—According to Rutherford's latest determination the ratio of the electric charge to the mass of alpha particles is just about half that for the hydrogen atom. This fact may be interpreted by various hypotheses. It may mean that the positive elementary charge is attached to two hydrogen atoms or that two of them are attached to one helium atom or that one of them is attached to half a helium atom, if this is possible. The present author gives a new and rather daring interpretation as follows: The alpha particles are atoms of an elementary substance, not isolated as yet, from which all other elements, except hydrogen, are made up. He calls it "alphon," and supposes that each atom of alphon is endowed with an elementary positive charge, and goes to constitute alpha-rays and canal rays. "Alphadas" are molecular weights which are multiples of two. He recasts the periodic system, making it consist of 15 horizontal rows instead of 11, and assigns to each element its nearest "alphad" weight. The greatest discrepancies are in silver 118 (really 108), and vanadium 46 (really 51.2). But taken over the whole series the discrepancies disappear. The sum of all the alphads is 7728, and the sum of all observed weights 7723.65, a difference of less than one-tenth per cent.—*Ann. der Physik.,* No. 6; Lond. *Elec. Eng'ing,* June 20.

Electrochemistry and Batteries.

Gas Cell and Carbon Cell.—A. BERTHIER.—The first part of an article in which the author emphasizes the importance of further studying the gas cell and the carbon cell, and gives a review of the whole subject. In the present installment the author deals with gas cells.—*L'Eclairage Elec.,* June 22.

Units, Measurements and Instruments.

Loading Stationary Induction Apparatus for Heat Tests.—G. C. SHAAD.—In determining the heating of transformers and regulators in almost all cases some modifications of the "loading-back" methods, as employed in the testing of motors and generators, may be used with the result that the apparatus is run under very nearly operating conditions and the power supplied is only equal to that of the losses of the apparatus to be tested plus the losses taking place in a few small auxiliary transformers. The simplest loading-back method of testing two transformers of the same voltage and reading is indicated in Fig. 8. The arrangement is self-explanatory. The generator *G* supplies the core losses of the transformers. The primaries are connected in series with their potentials opposing, as indicated by the relative signs, and into this primary circuit is introduced, by means of the transformers shown, a potential equal to the sum of the impedance voltages of the units under test. When a single unit is to be tested it is often possible to form a combination of shop transformers, or transformers of a different voltage and rating, in such a way that a large part of the power represented by the full load of this transformer is returned to the source of supply. An example of such a combination is shown in Fig. 9. Here a 300-kw, 13,200/370-volt unit is loaded by means of two 200-kw, 6000/370-volt transformers. The potential strain on the 6000-volt unit is, of course, increased over normal when their primaries are connected in series. Assuming that the load impedance voltage of the 300-kw unit is 400 volts at full-load, then a transformer combination, giving 800 volts in opposition to the 1200 volts difference between 13,200 and 12,000 volts, should be connected as shown in the diagram and this would limit the current flow

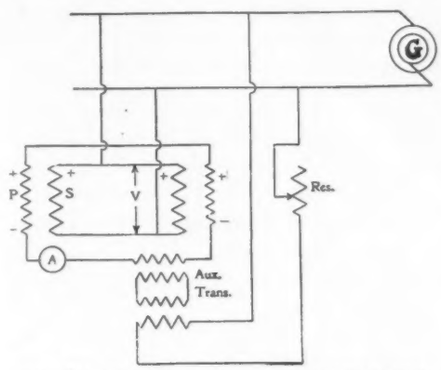


FIG. 8.—METHOD OF TESTING TRANSFORMERS.

to normal value when full potential is applied to the secondaries. If three one-phase transformers of the same type are to be tested and a three-phase source of power is at hand the method is as follows: The secondaries are connected in three-phase delta and normal voltage fed to them from a three-phase source. The primaries are also connected in delta, but at one corner of the delta there is inserted a transformer combination such as will give the combined impedance volts of the three units and the desired current is caused to circulate in the wind-

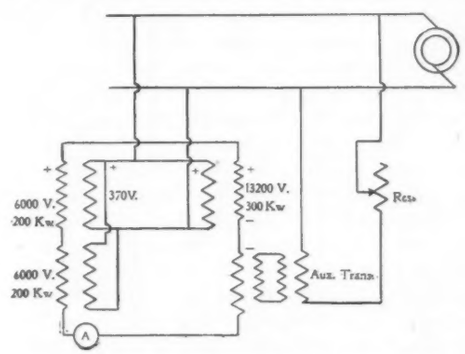


FIG. 9.—METHOD OF TESTING TRANSFORMERS.

ings. The auxiliary transformers may be fed from one of the three phases or from a separate source through the intermediary of a regulating resistance. The regulating resistance may be replaced by a potential regulator. In Fig. 10 is shown an example of the connections for three 200-kw, 60-cycle, 6600-2 200 volt, air-blast transformers. The secondaries are connected in three-phase delta and fed from a 100-kw, three-phase machine normally giving 2300 volts, but reduced to 2200 volts by means of the field rheostat. The voltage necessary to force 30.3

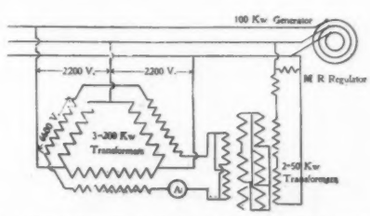


FIG. 10.—CONNECTIONS FOR AIR-BLAST TRANSFORMERS.

amperes full-load current through the high tension winding of one transformer with the low-tension coil short-circuited is 190. The total voltage required to be furnished by the auxiliary transformers is 560 for full-load and about 700 for 25 per cent overload. The auxiliary transformers used in this case

are two 50-kw, 2200/110-330/220/110-volt units and for normal load on the transformers in test they are connected step-down, step-up to give a ratio of four to one or furnishing 550 volts with 2200 volts impressed. The magnetic potential regulator is connected in the 2200-volt circuit and the potential raised until full-load current flows in the transformers under test. For the overload the connections of the low-tension windings of the auxiliary transformers would be changed to three coils in the first transformer in series feeding two coils of the second unit in series, thus giving 733 volts with 2200 volts impressed. The impressed voltage, in this case, would be cut down by means of the regulator, until the desired current flowed in the transformers being tested. Finally some notes are given on tests of feeder regulators and induction regulators.—*Electrical Journal*, June.

Telegraphy, Telephony and Signals.

High-Frequency Oscillations by Means of the Electric Arc.—W. L. Upsom.—An account of a (British) Physical Society paper in which the author gives a record of the appearance of arcs formed between electrodes of carbon, copper, iron and aluminum, taken in all possible pairs, and struck in air, hydrogen and coal gas. In many of the experiments one of the metal electrodes was cooled by water circulation after the manner of the Poulsen arc. The paper also contains the results of measurements of the voltage and current of various arcs of fixed length, and these measurements plotted to a current base yield curves of considerable interest in view of Poulsen's success with the cooled copper carbon arc in hydrogen. The author shows, in fact, that for such an arc in particular the slope of its characteristic curve is very steep, and, like the solid carbon-carbon arc in air, is negative. These properties are two very necessary ones for an arc that is to be used like the Duddell musical arc, for converting continuous current into high-frequency alternating current. A principal feature of these characteristic curves of the various arcs between the metals (including carbon) experimented with is that whenever aluminum forms one electrode the characteristic curve is remarkably steep. This is a point that may be found of value in the development of Poulsen's method. After the reading of this paper, Dr. Fleming gave an exhibition of the effects produced by oscillations generated by the Poulsen arc, and described how he had made a rough estimate of the efficiency of the arc method, and had found that the proportional energy radiated was of much the same order as in the spark method, namely, about 40 per cent.—Lond. *Elec. Eng'ing*, June 20.

Telegraph Perforator.—An illustrated description of the Creed receiving telegraph perforator which has recently been introduced into the service of the British Post Office and several cable companies. This perforating receiver reproduces at a rate of about 150 words per minute as a maximum, an exact replica of the Wheatstone perforated tape prepared at the sending end of a circuit.—Lond. *Elec. Rev.*, June 14.

Railway Points and Signals.—Ferreira.—A paper read at the Engineering Conference at the (British) Institution of Civil Engineers on the application of electricity to the working of railway points and signals. The general requirements are pointed out and it is said that the maintenance of an electric system should not cost more than that of the manual system, as the money spent in cleaning, oiling, painting and renewing rods and wires is saved and will be found to cover the cost of the electricity used, if an economical system is adopted.—Lond. *Eng'ing*, June 21.

Self-Starting Single-Phase Motor.

An interesting form of self-starting single-phase motor has recently been placed on the market by the Advance Electric Company, of St. Louis, Mo. The machine possesses the mechanical starting characteristics of a series motor and the operating characteristics of a shunt motor. Electrically it is constructed as a combined repulsion motor and single-phase induction motor, without mechanical devices for converting it from one machine to the other.

The machine is provided with a single primary winding of the usual construction, placed in slots in the stator core. There are two secondary windings on the rotor, one is of the squirrel-cage type similar to the secondary of an induction motor, the other is of the commutator type similar to the secondary of a repulsion motor. The latter winding is completely insulated from the core, and is short circuited on itself in a certain electrical plane at a desired angle from the primary winding by means of brushes on the commutator connected together. The former winding is placed in circular slots placed below the main

FIG. 1.—SINGLE-PHASE MOTOR.

slots and separated some distance from them, the bars of the winding being soldered to two end flanges. Thus considering this squirrel-cage winding in connection with the primary winding, the machine is a single-phase induction motor with large magnetic leakage; it has a good operating torque when the speed is near synchronism, but has no starting torque whatsoever. Considering the commutator winding in combination with the primary winding, the machine is a plain repulsion motor exerting a torque which is largest at starting but does not decrease to zero at synchronous speed. In the actual machine the repulsion motor characteristics predominate at starting, while the induction motor characteristics predominate under running conditions.

Performance curve of a ¼-hp, 110-volt, 60-cycle motor under service conditions are given in Fig. 2. It is noteworthy that when operating without load, the rotor runs slightly above synchronism; as load is applied the current decreases until the

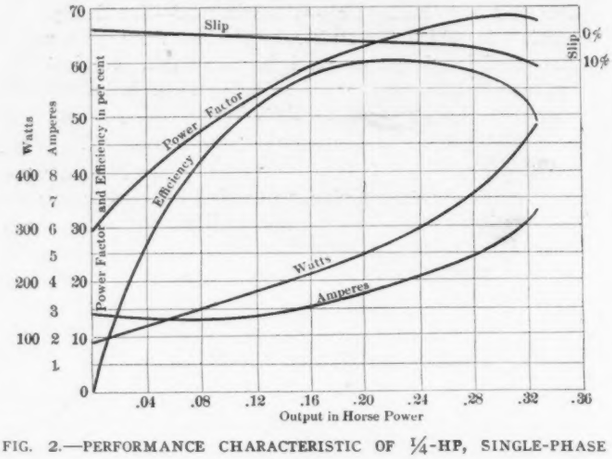


FIG. 2.—PERFORMANCE CHARACTERISTIC OF ¼-HP, SINGLE-PHASE MOTOR.

speed drops to synchronism, below which the current increases with the load. Moreover, the internal losses of the machine decrease slightly as the load is first applied, and subsequently increase with increase of load. The full load torque of the above machine is 6 lb-ft; the starting torque is 14 lb-ft or 233 per cent of the full load torque. In a recent starting test the motor took 10.3 amperes at 108 volts and consumed 600 watts.

The performance characteristics can be varied to a large extent by changing the relative position of the brushes and the stationary primary windings. The brush holders are rigidly

attached to the end plate and remain in a fixed position, but the stator core may readily be revolved to any position desired when the clamping studs are loosened; the position of the stator determines not only the operating characteristics but the direction of rotation. It is claimed that the motor may be operated at speeds much below synchronism by reducing the supply voltage, the tendency to burn and spark at the brushes being eliminated by the damping action of the squirrel-cage winding.

Dial Decade Testing Set.

The instrument illustrated herewith is a new form of dial decade testing set brought out by Leeds & Northrup, of Philadelphia. It is arranged for the measurement of conductor and insulation resistances, the location of faults, crosses and grounds by the Murray and Varley loop methods, and the location of open circuits.

The arrangement of the bridge arms is a departure from the usual type of dial set, in which it is customary to have a switch for each bridge arm and consequently any resistances due to poor contacts enter directly to affect the accuracy of the ratio coils. In this improved form any resistances due to the switch contact cannot affect the accuracy of the ratio coils, since the contact of the switch *S* is in the battery circuit. The resistances *a*, *b*, *c*, *d*, *e*, and *f*, which form the bridge arms, are

FIG. 1.—DIAL DECADE TESTING SET.

adjusted to a high degree of accuracy and are soldered to the contact studs as shown. Their values are such that when the switch *S* is placed at .01, .1, 1, 10, 100, the ratio *A/B* will be that indicated for any particular setting. The switch *S*, therefore, serves as the junction point of the arms *A* and *B* of the bridge.

This method of connecting the coils in the bridge arms also simplifies the manipulation of the bridge, since it is only necessary to multiply the rheostat setting for a particular balance by the setting of the bridge arm switch used in the same measurement. If the bridge arm switch is on the contact marked .1, then the unknown resistance is 1/10 of the rheostat setting; if the ratio 1 is used, then the unknown resistance is read in direct terms of the rheostat, or, if the ratio is 10, then the unknown resistance is 10 times the rheostat setting and so on. It will thus be noted that the complication of memorizing certain plug settings in order to produce the ratios *A/B* or *B/A* as is the case in plug bridges employing a commutator in the bridge arm, is avoided.

The rheostat coils consist of 10 units, 9 tens, 9 hundreds and 9 thousands, making a total of 10,000 ohms. Each dial has its switch made up of six brushes making independent contact and with the ends of the brushes bent so that they do not lie tangent to the circle in which they travel and consequently do not wear grooves or rings in the surfaces of the contact studs. The switches may be rotated continuously in either direction, thus moving from the highest point in any particular group of coils to the lowest without the necessity of turning back through all the other coils. This arrangement is very desirable when locating swinging crosses, since the bridge can be balanced with rapidity. The inner ring of each switch provides a continuous bearing surface so that any dependence upon friction in the central bushing for contact is avoided.

The parts have been grouped so as to provide for maximum convenience of manipulation. The switch heads stamped 1, 10, 100 and 1000 form the rheostat and the switch in the upper left-hand corner is the bridge arm switch. The small single-pole double-throw switches serve to arrange the bridge connections for resistance or loop testing and can be set for a particular

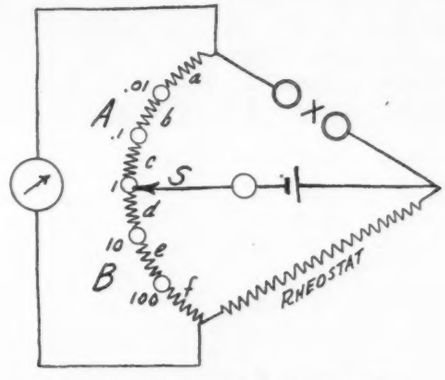


FIG. 2.—DIAGRAM BRIDGE OF CIRCUITS.

test by reference to the stamping on the switch ends without the necessity of referring to a diagram of connections.

The galvanometer is of the D'Arsonval type, and is not influenced by surrounding magnetic fields. It has been designed to withstand the rough usage to which portable testing sets are at times subjected. An Ayrton shunt is provided so that the galvanometer deflections may be reduced in proportions of .1 and .01.

The battery and galvanometer keys are of the lock-down type, which permits these circuits to be permanently closed when locating open circuits. The operator thus has the free use of his two hands for manipulating the set. A sensitive reflecting galvanometer or more battery may be used when locating high resistance faults, but for all ordinary purposes, the contained galvanometer is amply sensitive and the contained battery has sufficient e. m. f. The resistances are wound with manganin. By a special method of adjusting, which the manufacturers have employed, it is possible for the user of the bridge to replace a burnt-out coil without altering the accuracy of adjustment of the other resistances in the instrument.

Exhibits at the Jamestown Exposition.

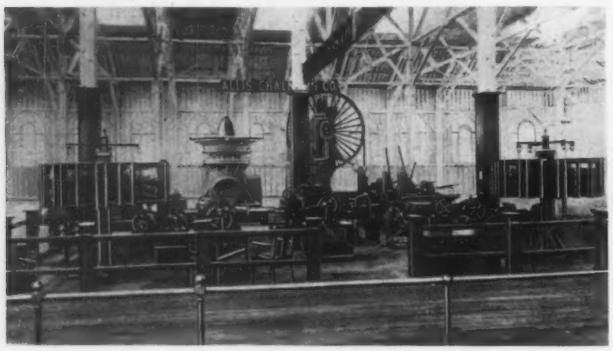
Among the principal exhibits of machinery at the Jamestown Exposition is that made by Allis-Chalmers Company, of Milwaukee, occupying Section 8, Machinery and Transportation Building, as shown in part by the accompanying illustration.

The character of this exhibit is not marked by the display of any unusual or special apparatus, nor does it include specimens of all Allis-Chalmers Company's extremely large and varied line of products, but only a few of the standard machines whose

designs have been well established, such as are used in thousands of installations the country over, and are doing efficient, economical, every-day service.

The electrical machinery shown includes a belted alternator and a Reliance engine, the latter of which is hidden in the background of the picture. There is also shown a complete line of apparatus for electric drive, including standard Allis-Chalmers induction motors and direct-current motors, whose liberal design and uniformly excellent service have distinguished them above the machines of all competitors.

In the photographs, model and parts of Allis-Chalmers steam turbines shown in this exhibit may be observed three of the special features, viz., channel-shaped shrouds protecting the ends of the blading from injury, machine cut slots in the foundation



ALLIS-CHALMERS EXHIBIT AT JAMESTOWN EXPOSITION.

rings insuring absolutely accurate spacing of the blades, and improved arrangement of balance pistons reducing the diameter of the cylinder and preventing distortion under varying temperatures.

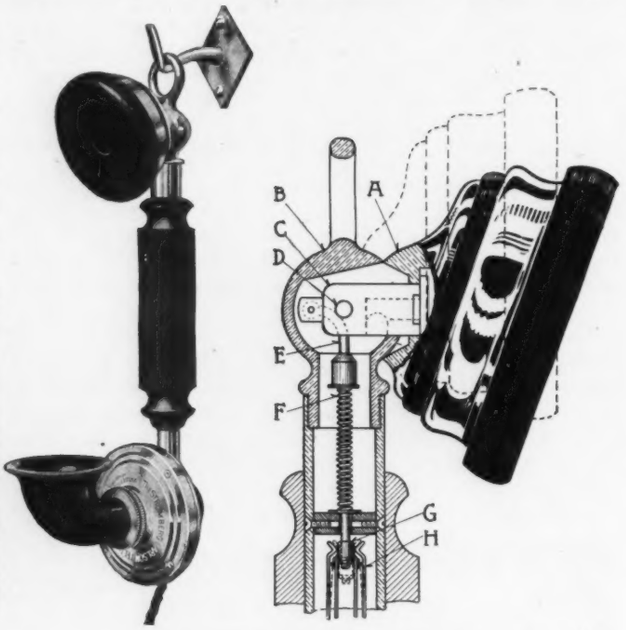
The greatly extended use of compressed air for driving drills, pneumatic riveters, hammers, cleaners, clipping and calking tools, etc., has created a strong demand for small air compressor plants which may be placed conveniently to the work in hand. A portable compressor outfit mounted on a truck, comprising a Christensen air compressor, built solely by the Allis-Chalmers Company, driven by a motor, may be seen here with all its accessories.

At either corner of the space are placed large swinging racks of frames containing protographs and illustrated summaries of bulletins of the principal products of the company.

Combination Telephone.

The instrument shown in the accompanying illustrations, while similar in some respects to most combination telephones of the type, differs decidedly in some details. A marked feature embodied in its design is the arrangement of the contact springs and plunger, or the switch-hook, in the handle without enlarging the size of the telephone. No triplet or hookswitch box is required, thereby providing a most convenient and compact telephone that can be placed anywhere and yet be ready for use. The illustration of the instrument hanging on a dummy hook shows the receiver in its normal position, but when placed to the ear it takes the position as shown in dotted lines in Fig. 2. The simple operation of placing the instrument to the ear signals the operator, and removing the receiver from the ear opens the contacts and gives the disconnect signal in the regular way.

Referring to Fig. 2, the lever *C* is rigidly fastened from the inside of the back plate *A*, and moves on the fulcrum pin *D*, which is driven through the socket *B* casing containing all the lever parts. When the receiver is moved upwards the foremost end of the lever *C*, in which is fastened the link *E*, is forced down, actuating the plunger rod *F*. This forces the rubber plunger *G* down, letting the operating contact springs *H* snap over the plunger and bringing them together. As the telephone is taken from the ear, the receiver is aided to drop to its normal position by the music wire helix, drawing the plunger up and opening the contacts as shown. The line can be held by placing the thumb against the receiver, and a signal



FIGS. 1 AND 2.—COMBINATION TELEPHONE.

for a new connection is given by moving the receiver backward and forward.

The Stromberg-Carlson Telephone Manufacturing Company has furnished these instruments for a variety of purposes, mostly for bank people and busy men who want something convenient but not cumbersome.

Marshall Field & Company Adopt Nernst Lamps.

Marshall Field & Company, of Chicago, have just awarded the largest contract ever placed for lamps for store lighting, calling for 12,000 Nernst glower units for immediate delivery. The store will be equipped a section at a time and on account of the vastness of the undertaking, the complete installation will perhaps not be in operation until well along into the Fall.

The store contains over 38 acres of floor space, and the average number of employees is 9000. While it is not a regular department store, it handles a great variety of the better classes of goods, such as dry goods, millinery, men's and women's clothing and furnishing goods, carpets, furniture, wall hangings, leather goods, pottery, glassware, jewelry, bric-à-brac, books, shoes, toys, sporting goods, etc. There is thus scarcely a problem in store illumination that this vast establishment does not exemplify, and at great expense, various modern systems of store illumination were installed in different sections and put to an exhaustive test before a decision was reached.

The 13 floors to be lighted vary in ceiling height from 14 ft. to 19½ ft. Two and three-glower lamps suspended on specially designed chain pendants hanging from three to five feet from the ceiling—according to height—will be used. The fixtures are particularly appropriate in design and the lighting units will add materially to the appearance of the store. Incandescent lamps to the number of more than 40,000, in low hanging fixtures, were formerly used. The energy is supplied by the Chicago Edison Company. Messrs. D. H. Burnam & Company are the architects in charge of the new building construction, now practically completed. The new lighting system will be installed under the direction of Mr. F. J. Pearson, electrical engineer for Marshall Field & Company.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—A vast amount of business was transacted notwithstanding the interruption of a holiday and the usual inventories and midsummer stoppage of machinery for repairs. Settled warm weather has reduced stocks of summer fabrics at many points where congestion was threatened, and in some cases supplementary orders from wholesalers replenish depleted stocks that it was feared would be carried over to 1908. Crop news is encouraging, on the whole, although grain rose sharply in response to aggressive manipulation, and cotton was affected by an official report of condition that fell below expectations. One of the most favorable developments of the week was the improvement noted in collections at many markets, a sure sign that retail stocks are moving, though the number of cities reporting reduction sales of slow trade is sufficiently large to show that trade in summer wear has not in all cases been satisfactory, and the usual measures of business, such as clearings and failures, point to irregular conditions. Thus the clearings of the entire country have fallen behind 1906, due entirely to New York's loss, which is assigned to speculative dullness, as outside of the metropolis clearings gained over the first half of 1906. All of the railways reporting for the month of May showed good gains in gross earnings, but small increases in net. In failures it is to be noted that the number is down to the lowest minimum of the last 25 years, but the liabilities are the largest, with one exception, for ten years past. There were 4792 failures reported to *Bradstreet's* for the first six months of 1907, involving liabilities of $76,529,059 and assets of $42,018,143. This is a decrease in number of 1.6 per cent from 1906, of 8.5 per cent from 1905, of 10.2 per cent from 1904, and almost identical with the number reported in the first half of 1903. With this exception the number of failures is the smallest reported in the first half of the year since 1882. As regards liabilities, however, the showing is different, owing to a number of relatively large suspensions this year. Thus the liabilities in 1907 are 30 per cent larger than in 1906, 22 per cent larger than in 1905, but 8 per cent smaller than in 1904. Compared with 1903 liabilities are 27 per cent larger, and, with the exception of 1904, liabilities this year so far are the largest since 1897. Copper is quoted at 23⅝c. for lake; 22⅛c. for electrolytic, and 21⅛c. for casting stock. The exports last month were 16,193 tons, an increase of 7183 tons over May, a decrease of 1070 tons compared with April, and a decrease of 2441 tons compared with June a year ago. In the six months from Jan. 1, copper exports were 81,583 tons, comparing with 101,765 tons in the corresponding period last year.

THE MEXICAN LIGHT & POWER COMPANY, which has contracted with the Street Railway Company, of Mexico, to supply 5000 horse-power for operating the tramways, has recently ordered 8000 horse-power capacity transformers to come from the works of the Westinghouse Electric & Manufacturing Company through G. & O. Braniff & Company, the representatives for the Republic. These transformers will be divided into six units of 1000 kilowatts each, the transformer being single-phase. The energy is transmitted to Mexico City from Necaxa at 60,000 volts, which passing through transformers is reduced to 20,000 volts at the Power Company's Nonoalco sub-station. At this voltage the energy is distributed to five different sub-stations located at different parts of the city, Churubusco, Alameda, Inlianilla, etc. These new transformers will reduce the voltage received at 20,000 to approximately 3000 volts for the motor generator sets in these respective sub-stations, the motor generator sets being used to change the alternating current to direct current for the trolley circuits at approximately 600 volts. A part of this additional transformer capacity will be also used by the power company for lighting and power service in the vicinity of the districts where they are installed.

MUNICIPAL PLANT FOR FRANKLIN, LA.—Contract has just been let to Muralt & Company, engineers, of 114 Liberty Street, New York, for a complete modern municipal electric light plant for the town of Franklin, La. This town is one of the oldest settlements in that part of the country. As a matter of fact it is the locality made famous by Longfellow's "Arcadia." At the same time it is progressing along modern industrial lines and in addition to having lately installed an extensive central market building it has now just passed the above-mentioned contract for an electric light plant. The latter will be of sufficient capacity to furnish electric light to the 4000 or more inhabitants and electric power to several sawmills and sugar refineries. In addition, there will be a street lighting system of 25 arc lights and 40 incandescents. The power house will contain Heine safety boilers, Harrisburg engines and Fort Wayne electric apparatus. The contract calls for getting out the machinery in three months and the complete plant is expected to be in operation early the coming fall. Mayor J. C. Lewis, of Franklin, was the moving spirit in getting this plant and he was unanimously supported by the Franklin Council. The plans and specifications were prepared by Warren B. Reed, consulting engineer, of New Orleans.

ALASKAN POWER.—The largest grant ever made for water in the Yukon has just been issued by the Minister of the Interior, Frank Oliver, to the Yukon Milling, Dredging & Power Company. The grant is for 50,000 ihs. of water from the Klondike River for 20 years. The diversion is to be made from the river at a point three-quarters of a mile above Rock Creek, which is 15 miles from the mouth of the Klondike. The company receiving the grant receives also authority to use the water for generating power and to transmit and sell it. The power is to be developed by Pelton wheels. The grantees get the right to 50,000 ins. at all times of the year. The flow of the Klondike at low water is only 54,000 ins. At ordinary states of water it is 100,000 ins. At high water it is 305,000 ins. The Twelve Mile carries 8000 to 20,000 ins., varying according to the season.

ELECTRIC VENTILATION.—The approach of warm weather is rapidly increasing the sales of electric propeller fans by the B. F. Sturtevant Company, of Boston, Mass. Among recent orders are the following: Bausch & Lomb Optical Company, Rochester, N. Y.; Washington Water Power Company, Spokane, Wash.; Sewer Pumping Station, Washington, D. C.; J. T. Stanley, New York City; American Lithographing Company, New York City; Brace Brothers, Wilkinsburg, Pa.; G. W. Miller, Toronto, Ont.; Klots Throwing Co., Scranton, Pa.; Hotel Touraine, Boston, Mass.; St. Augustin's R. C. Church, Newark, N. J.; Victor Talking Machine Company, Camden, N. J.; Stecher Lithographic Company, Rochester, N. Y.; Lewis & Kitchen, Kansas City, Mo.; Hermit Club, Cleveland, Ohio, and Why Lunch Company, New York City.

PROTECTING HYDROELECTRIC PLANTS.—In order that it may not have any trouble in the future through ice clogging its turbines, the York Haven (Pa.) Water & Power Company is having a spillway erected in its dam in the Susquehanna River at a cost of about $50,000. The spillway is practically an extension of the wall of the dam and reaches from the big wall to the western shore of Duffey's Island. It has a width of 18 ft. and has a slope of sufficient depth to allow anything that happens to be in the water to pass over it easily. The improvement is being made under the supervision of E. F. Baker, superintendent of the company. Steps are also being taken to enlarge the capacity of the plant.

RUBBER MANUFACTURE IN JAPAN.—A company with a capital of $1,000,000 has been formed for the manufacture of rubber products. The greater part of the capital has, it is stated, been subscribed by foreigners. The factory will be located at Osaka.

GENERAL ELECTRIC COPPER.—Advices from Boston state that the General Electric Company is expending about $1,000,000 in developing and placing its Bully Hill copper property in California upon a producing basis. For a year and a half development work has been progressing without net returns of any moment. It is understood that it has been definite-

ly decided to double the capacity of the Bully Hill smelter and instead of two furnaces there will be four with reduction capacity of 1200 to 1500 tons per day. President Riordan says that the whole plant will be reconstructed at a cost of between $300,000 and $400,000. The Bully Hill Company is expending at least $500,000 in the building of 18 miles of railroad connecting its smelting plant at DeLamar with the Southern Pacific about two miles above Kennet. It is estimated that this road will effect a saving to the Bully Hill Company of $4 per ton in coke supplies and a pro rata saving on all freight. The Bully Hill should be able to supply 25,000,000 lbs. of copper per annum to the General Electric Company at a cost of about 10 cents per pound. On 15-cent copper this would mean an annual saving to the General Electric Company of $1,250,000 and on 20-cent copper $2,500,000. The company's total investment, including the purchase of the property, will probably be in the neighborhood of $2,500,000, so that the General Electric Company may get its total investment back in between one and two years. The copper requirements of the company amount to about 1,500,000 lbs. per week, which is at the rate of 75,000,000 lbs. per annum.

BREAK IN COPPER.—On Tuesday of this week the deadlock between producers and consumers of copper, which has lasted for several months, was broken and a reduction of 3c. or more was made from the price of the last previous sale. Though rumors were heard of selling at considerably reduced prices by both the United Metals Selling Company, which handles all the product of Amalgamated, and by the Calumet and Hecla, the only reduction which was officially confirmed was in the case of Phelps, Dodge & Company, who deal in electrolytic copper entirely. They reduced their price from 25 cents to 22 cents a pound. It was reported that Calumet and Hecla had sold some of its product at 23, a reduction of 3½ cents from the former price, and that the United Metals Company was quoting certain grades of lake copper at 22⅛. That the reduction of the price was the outcome of a conference between the large consumers and producers was the common belief.

ORDERS FOR GENERATORS.—Among recent sales of electric generating sets the B. F. Sturtevant Company, of Boston, Mass., report the following: Electric Construction Company, Richmond, Va.; McCann Ice Plant, Philadelphia, Pa.; Bethlehem Brewing Company, New Bethlehem, Pa.; Smith & Hammond lumber steamers; Eberhard Faber Pencil Company, Brooklyn, N. Y.; Metric Metal Works, Erie, Pa.; Hanover National Bank Building, New York City; Sedalia Ice, Light & Fuel Company, Sedalia, Mo.; H. J. Kunzig, Philadelphia, Pa., and Board of Water Supply, New York City.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market showed considerable strength throughout the week and quotations advanced on moderate buying in spite of the high rates for money. Call loans touched 15 per cent on Monday, but eased off later. At the close of the week the market was strong and very active. The whole list showed good gains with prompt advances in such stocks as St. Paul, Amalgamated Copper, New York Central and Union Pacific. Most of the active shares on Saturday touched the highest level of the week, and although the market was professional, there was some outside support. Of the electric stocks General Electric and Westinghouse are the only ones which show declines in face of the generally strong market. The curb market developed greater activity during the week, with the volume of transactions nearly twice as large as the previous week. Gains of 1 and 2 points were scored for many stocks, the mining issues being the features. The table shows the closing quotations of July 9.

NEW YORK.

	July 2	July 9		July 2	July 9
Allis-Chalmers Co.....	10	11¼	General Electric 138		137¾
Allis-Chalmers Co. pfd..	29	28¼	Hudson River Tel.....	—	—
Am. Dist. Tel.....	—	20	Interborough Met. com.	16	17
American Locomotive...	58⅜	58½	Interborough Met. pfd..	43¾	45⅞
Amer. Locomotive pfd..	105	103	Mackay Cos.....	—	66½
American Tel. & Cable..	75	75	Mackay Cos pfd.....	—	65
American Tel. & Tel....	109	108	Marconi Tel.	—	—
Brooklyn Rapid Transit.	56	59¼	Metropolitan St. Ry....	*95	—
Electric Boat	33	33	N. Y. & N. J. Tel.....	100	100
Electric Boat pfd.....	80	80	Western Union Tel.....	79½	77½
Electric Vehicle	—	—	Westinghouse com.....	143	143
Electric Vehicle pfd....	—	—	Westinghouse pfd.....	—	142

BOSTON.

	July 2	July 9		July 2	July 9
American Tel. & Tel....	109	109	Mass. Elec. Ry. pfd.....	—	*58
Cumberland Telephone..	—	—	Mexican Telephone	2⅛	2½
Edison Elec. Illum.....	214	215	New England Telep....	110	110
General Electric 138¾		—	Western Tel. & Tel.....	5	5
Mass. Elec. Ry.....	—	16¼	West. Tel. & Tel. pfd..	—	*70

PHILADELPHIA.

	July 2	July 9		July 2	July 9
American Railways	48½	48½	Phila. Electric	8⅜	8⅜
Elec. Co. of America...	9⅞	9⅞	Phila. Rapid Transit....	24¼	23½
Elec. Storage Battery...	51	52	Phila. Traction	94	93½
Elec. Stor. Battery pfd..	—	—			

CHICAGO.

	July 2	July 9		July 2	July 9
Chicago City Ry.....160		160	National Carbon.....	—	71
Chicago Edison 144		*145	National Carbon pfd....	—	111
Chicago Subway	25¼	—	Union Traction	3½	—
Chicago Tel. Co.....125		122½	Union Traction pfd.....	18	—
Metropolitan Elec. com.	23½	23			

* Asked.

BUCKET SHOPS.—Notwithstanding the general complaint among commission houses of the lack of public interest in the stock market, it is stated that the bucket shop interests, driven under cover by the recent laws in Massachusetts and Pennsylvania, are making strenuous efforts to establish connections with the stock market in New York. The officers of the Stock Exchange, through their detective bureau, are said to have scented danger of some of the bucket shops connecting with firms on the Exchange. Secretary Ely has issued circulars to the Stock Exchange firms calling attention to the provisions of the constitution that all wire connections with offices or persons not members of the Exchange, engaged in the banking or brokerage business, whether by telephone or telegraph, must be registered with and approved by the committee of arrangements. Circulars have also been sent out calling attention to the necessity of receiving the approval of the committee on commissions for all branch offices in New York or elsewhere, which must also be registered. These two circulars ask the members to comply with the regulations.

MESSENGER SERVICE.—The United Electric Service Company has applied to the Board of Estimate for a franchise in Manhattan. This company wishes to establish a messenger call box system. "Big Tim" Sullivan, Tammany leader, is supposed to be behind the company. The concern applied for a franchise under the name of the United District Messenger Company, as the corporation counsel advised its officials to organize under the transportation corporations law instead of under the business corporations law. The company operates chiefly in the financial section and on the upper West Side. He says the company contends that "it has been impossible to install boxes profitably because of the exorbitant rates charged by telephone companies for the use of their wires. The rate charged is $108 a mile for each pair of wires, but since the application of the company for a franchise the rate has been cut in half. But the telephone companies have refused to lease any additional wires."

WESTINGHOUSE NOTES.—Kuhn, Loeb & Co. have taken an issue of $6,000,000 Westinghouse Electric notes dated as of Aug. 1 next which will bear 6 per cent interest and will run for three years. They will be used to pay off the $6,000,000 of notes which mature on that day. The new notes will be secured by $6,000,000 Lackawanna & Wyoming Valley Rapid Transit 5 per cent first lien bonds, $3,000,000 Westinghouse Electric assenting stock, and $3,000,000 (market value) of British Westinghouse Electric debentures. The notes have been taken by Kuhn, Loeb & Co. They were being offered to investors last week at 97½.

AMERICAN RAILWAYS BONDS.—A syndicate composed of Bioren & Co., Newburger, Henderson & Loeb, and E. C. Miller & Company, all prominent Philadelphia banking houses, is offering a block of $600,000 of 10-year collateral trust 5 per cent gold bonds of the American Railways Company for public subscription. These bonds are offered at 92 and interest. They are due on April 1, 1917, and will yield more than 5½ per cent. This is a recent issue of the American Railways Company, for the purpose of supplying the funds needed in the expansion of business.

TEXAS TELEPHONES.—The local independent telephone exchanges in 20 of the principal towns of Texas and several long distance telephone lines have been purchased by the Central Texas Telephone Company and have been merged into one system and under one management.

DIVIDENDS.—The Little Rock Railway & Electric Light Company has declared semi-annual dividends of 3 per cent on preferred stock and 2 per cent on common.

GENERAL NEWS

Construction News.

MOBILE, ALA.—Sanderson & Porter, of New York, N. Y., have been engaged as consulting engineers in connection with the enlargement of the power plant of the Mobile Light & Railroad Company. The company has placed contracts with the Babcock & Wilcox Company for two 512-hp boilers and has purchased Rodney stokers; one central condenser, and is preparing to install coal-handling apparatus. In addition to the above there will be installed stacks, pumps and heaters, for which the company is now receiving bids. J. H. Wilson is president.

BERKELEY, CAL.—The Oakland Traction Company has been granted franchises by the Town Trustees to construct lines on several cross-town streets.

FRESNO, CAL.—It is said that H. E. Huntington is planning to build an electric railway between Fresno and the Yosemite. Surveys by the way of Crane Valley, a distance of 96 miles, have been completed. The road will cost $3,000,000 and electricity for operating the line will be furnished by the San Joaquin Power Company, which is controlled by the Huntington syndicate.

ST. HELENA, CAL.—H. M. Pittman has purchased the property of the St. Helena Fruit Drying & Packing Company, at Barre Station, from A. D. Butler and proposes to establish an electric plant there for the purpose of furnishing electricity for lighting and power purposes in St. Helena and Calistoga.

SAN BERNARDINO, CAL.—The Arrowhead Reservoir & Power Company, which recently took over the Arrowhead Reservoir Company, has increased its capital stock from $6,000,000 to $6,500,000 and is now preparing to float a bond issue equal in amount to its capital stock. The money will be used to complete the large irrigation and power projects of the company north of the city.

SAN DIEGO, CAL.—The City Council has passed an ordinance granting the Point Loma Electric Railroad Company a franchise to construct and operate a street railway in the city.

SAN MATEO, CAL.—Peter Thorsen and J. Johns, of the San Mateo Construction & Contracting Company, have applied to the Board of Trustees for a franchise to construct and operate an electric railway system in this town and to Burlingame. The name of the company is to be the People's Railway Company and it contemplates using the underground conduit system.

SANTA CRUZ, CAL.—The Big Creek Power Company is now erecting a new steam plant in this city having a capacity of 1800 horse-power. The water power plant of the company, located 18 miles from Santa Cruz, is to be entirely rebuilt during the year, and the capacity of the plant increased from 800 to 2500 kw. The improvements will involve an expenditure of $500,000. The work is being carried on under the supervision of F. E. Fitzpatrick, general manager of the Coast Counties Light & Power Company and S. W. Coleman, general manager of the Union Traction Company.

YREKA, CAL.—The Siskiyou Electric Light Company is increasing the capacity of the Fall Creek plant on the Klamath River by the installation of new machinery. The entire system is now being operated by the Shasta River plant, while repairs are being made to the Fall Creek plant.

DENVER, COL.—Announcement has been made that the controlling interest of the Denver City Tramway Company has been transferred to a syndicate of New York and Providence capitalists, the members of which are Marsden J. Perry, Benjamin A. Jackson and Col. Samuel P. Colt, of Providence, R. I.; D. C. Clark and W. L. Bull, of New York, N. Y.

DENVER, COL.—The Central Colorado Power Company has filed a mortgage of $20,000,000 in the clerks' offices of Larimer, Grand, Summit, Lake, Eagle, Pitkin, Garfield and Denver counties. The property covered includes the De Remer water power location at Shoshone Falls above Glenwood Springs, where work is already under way, also the Gore Canon plant, and the third plant, which will be located on Roaring Fork near Aspen. The three plants of the company will have a combined capacity of 125,000 horse-power. In addition the company will have six storage reservoirs, two on upper Roaring Fork and four on Grand River.

BRIDGEPORT, CONN.—The Eaton, Cole & Burnham Company is planning to erect a brick power house on the South Avenue extension.

BRISTOL, CONN.—The five-year contract between the town and the Bristol & Plainville Tramway Company for electric lighting expired July 1. There are now 99 lamps used by the town at a cost of $70 per lamp per year on a moonlight schedule. The Selectmen will soon call a special town meeting to consider the renewal of the contract. The citizens are considering the use of arc lamps for the center of the town and incandescent lamps in the residential districts.

FAIRFIELD, CONN.—The General Assembly has granted a renewal of the charter of the Fairfield Electric Light Company. The company is now making arrangements to construct a plant and expects to have its system in operation before next winter.

HARTFORD, CONN.—A resolution incorporating the Bridgeport & Danbury Electric Railway Company has been passed by the Legislature over the Governor's veto. The company is capitalized at $1,500,000.

HARTFORD, CONN.—The House of Representatives on June 28 rejected the Senate amendment to the bill of the Glastonbury Power Company. The amendment prohibited the company from doing business in the territory of the Hartford Electric Light Company without contract with that company.

NORWICH, CONN.—The City Council has authorized the Gas and Electric Commissioners to make the necessary improvements and additions to the municipal electric lighting plant, the cost not to exceed $30,000. The money will be expended to furnish a site for the Uncas Power Company's sub-station and other electrical apparatus as provided in its contract with the city, and to provide for the rapidly increasing demands for both gas and electricity, which will require additional primary lines from the station to central points of distribution in the city, also to furnish new transformers and meters for new customers.

TORRINGTON, CONN.—The office and storehouse of the E. A. Perkins Electric Company were recently destroyed by fire, causing a loss of $15,000.

WILMINGTON, DEL.—J. Ernest Smith, representing the Commercial Light, Heat & Power Company, on June 29 paid to the city treasurer $6,250, which was the second installment due the city on the amount promised in return for the franchise granted the company by the Street and Sewer Department to lay gas mains in the streets of the city. The company has agreed to pay the city $50,000, half of which is to be paid by the Delaware Electric Transmission Company.

WASHINGTON, D. C.—Bids will be received until July 20 by Elliott Woods, superintendent U. S. capitol buildings and grounds, for weatherproof and rubber covered electric wires for House of Representatives office building, material to be delivered on reels at the building.

DE KALB, ILL.—The De Kalb, Sycamore & Interurban Traction Company has filed a certificate with the Secretary of State showing an increase of capital stock from $100,000 to $1,500,000.

FORT WAYNE, IND.—Contracts for the construction of the municipal electric lighting plant were awarded on June 26 as follows: To Fort Wayne Electric Works, Fort Wayne, for section 3, steam turbine generators and exciters; section 4, condenser equipment; section 7, arc-lamp transformers, switchboard, appliances and station electrical work; section 8, arc lamps, and section 10, transformers and connecting public buildings, for a total of $73,899. To McBride Electric Company, of St. Paul, Minn., for section 9, pole line and wiring system and underground (distributing system), and section 11, power plant and coal storage, for a total of $56,002. To the O. K. Engineering Company, of St. Louis, Mo., section 1, boilers and equipments and stack connections, and section 5, feed-water heater, boiler, feed pumps, separators, pipe work and connections, for a total of $19,220. To Alphons Custodis Chimney Construction Company of Chicago, Ill., for section 2, stack, for $4,300, and to the Moellering Construction Company, of Fort Wayne, section 12, dam in Spy Run, for $1,238.

FRANKLIN, IND.—J. B. Rogers, manager of the Franklin Water, Light & Power Company, writes that the company expects to get its new franchise early in July, when the plant will be remodeled and the following new equipment installed: A new engine direct connected to a 250-kw, three-phase alternator, a new 125-kw, three-phase alternator to take the place of the present machine and belted to the engine already installed. One 75-light transformer to take the place of the direct-current arc machine, when all arc lamps will be changed to alternating-current series enclosed lamps. When the improvements are completed a 24-hour service will be established and electricity will be furnished for power purposes.

NILES, IND.—The City Council has authorized the Board of Public Works to proceed with the erection of a new brick building at the municipal electric light plant, to cost $6,000.

RED FORK, I. T.—The Sequoyah Park Company has been organized for the purpose of constructing an electric railway and improving Sequoyah Park. The company contemplates an expenditure of $100,000 for improvements and construction of the line, which will be 11 miles in length.

CRESTON, IA.—Extensive improvements are to be made to the equipment and system of the Creston Mutual Telephone Company, which will involve an expenditure of about $12,000.

MASON CITY, IA.—The Western Electric Telephone Company is contemplating making improvements to the local systems, which will involve an expenditure of $75,000.

ORANGE CITY, IA.—The citizens of this town are considering the proposition of erecting a municipal lighting plant.

KINSLEY, KAN.—The electric plant of the Kinsley Electric Light & Power Company has been taken over by A. D. Coleman and Albert L. Moe, of Albuquerque, N. M.

PENOBSCOT, ME.—Certificates of organization of the Penobscot Bay Electric Company have been filed with the Secretary of State. The company proposes to develop the water power at Orland for the purpose of generating electricity for light and power purposes, which will be distributed in the towns of Bucksport, Orland, Penobscot, Castine, Bluehill, Winterport, Frankfort, Stockton Springs and Verona. The capital stock of the company is $200,000, and the officers are: William M. Shaw, of Greenville, president, and Albert H. Shaw, of Bath, treasurer.

BALTIMORE, MD.—The Baltimore, Halethorpe & Elkridge Railway Company has secured the right of way for an electric railway between Baltimore and Halethorpe, work on which will commence within a short time.

BALTIMORE, MD.—At the annual meeting of the Consolidated Gas, Electric Light & Power Company, held July 1, plans were announced for erecting an addition to the Westport electric power plant, which provides for a structure large enough to provide for 72,000 horse-power. One-third of the structure will be erected this year, and a turbo-generator set of 7500 horsepower has been ordered, with boilers and necessary equipment.

BALTIMORE, MD.—As it is costing the city nearly twice as much to light the City Hall and court house by its own plant as it is paying the local electric companies for lighting the other public buildings and places, the Mayor has instructed Superintendent of Lamps and Lighting, McCuen, to prepare proposals for lighting the city hall and court house. The city plant in the court house costs the city 12 cents per kw-hour, while the other buildings are lighted at the rate of 6¾ cents per kw-hour. If it is decided to light the two buildings by competition the city plant will be abolished.

AMESBURY, MASS.—A new Rice & Sargent engine of 300 horsepower has been installed in the plant of the Amesbury Electric Light Company. The engine is direct connected to a 200-kw generator.

ARLINGTON, MASS.—The Board of Selectmen has recently closed a 20-year contract with the Edison Electric Illuminating Company, Boston, Mass., for street lighting and lighting the municipal buildings. The long term contract secures a reduction of 20 per cent from the rates on a one-year contract.

BOSTON, MASS.—Bids will be received until July 16 by the Trustees of the Boston City Hospital for electric wiring the East Boston Relief Station on Porter Street, East Boston. George H. M. Rowe is superintendent.

BOSTON, MASS.—The board of arbitrators, consisting of Samuel H. Hudson, Dugald C. Jackson and Herbert A. Wagner, who were appointed some time ago to consider the matter of the city's contract with the Edison Electric Illuminating Company, with a view to securing a reduction for the cost of electric lighting, have succeeded in bringing about better terms between the company and the city. At the present rate of consumption a saving of $17,300 a year has been secured by the board, or a total of $43,250 for the two and one-half years preceding Feb. 20, 1909, when the present contract expires.

BROOKLINE, MASS.—Bids will be received by the Board of Selectmen until July 15, for street lighting for a term of six years on specifications to be drawn up by the superintendent of wires and lights.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company has asked for permission to erect poles for a high-tension power line across Rocky Mountain and the town from the river electric plant of the Turners Falls Company.

MARLBOROUGH, MASS.—The Marlborough Electric Light Company has petitioned the Board of Electric Light and Gas Commissioners for permission to issue additional capital stock to the amount of $170,000, the proceeds to be used for paying the funded and floating debt of the company and the cost of permanent improvements to the plant.

MILLERS FALLS, MASS.—The committee appointed on the lighting investigation has recommended that the offer of the Franklin Electric Light Company, of Turners Falls, be accepted. At a special meeting of the fire district, held July 1, the commissioners and the investigation committee were authorized to enter into negotiations with the company to furnish electricity to operate the municipal electric lighting system. The company offers to furnish electric energy to the Millers Falls district at the following rates: 3½ cents per kw-hour up to 40,000 kw-hours per year; 3¼ cents per kw-hour from 40,000 to 50,000, and 3 cents per kw-hour for all over 50,000 kw-hours, unless the amount should be so great as to warrant a special contract.

PETERSHAM, MASS.—The plan of establishing an electric lighting system in this town is now under consideration. It is intended to erect a plant to supply electricity for street and residential lighting.

SPRINGFIELD, MASS.—The United Electric Company has awarded a contract to W. H. Falvey, of this city, for the construction of a one-story power house, the cost of which is estimated at $15,000.

TAUNTON, MASS.—The City Council is considering the proposition of increasing the capacity of the municipal electric lighting plant. It is stated that a large number of additional street lamps have been called for which cannot be installed unless an additional engine is placed in the plant. The demand for electricity for power purposes is increasing rapidly, which call for increased facilities at the power house.

WEBSTER, MASS.—The Board of Electric Light and Gas Commissioners has authorized the Webster Electric Company to issue 650 shares additional capital stock to enable it to purchase the Southbridge Gas & Electric Company. The commissioners have also approved the issue of an additional 100 shares to pay for the extension of lines, par value $100.

WINCHESTER, MASS.—The town of Winchester has decided to abandon the moonlight schedule for its street lighting, and will have the lamps lighted every night until midnight. This will not involve a new contract and only a slight additional expense. The electric lighting service is furnished by the Edison Electric Illuminating Company, of Boston.

CHARLOTTE, MICH.—The Commonwealth Power Company, of Jackson, has notified this city that its power is contracted to the capacity of its plants and that it will be unable to take the contract to light the city for a year and perhaps for a longer period.

HOLLAND, MICH.—The Board of Public Works is contemplating entering into negotiations with the Grand Rapids-Muskegon Power Company to supply electricity for operating the municipal electric lighting plant during the coming winter.

KALAMAZOO, MICH.—Frank W. Armstrong, of Chicago, Ill., is reported interested in the establishment of a heating and power plant in this city for the purpose of furnishing power to the manufacturing industries of Kalamazoo.

MANCELONA, MICH.—The Stover dam, which supplied power for the lighting system at Mancelona, is being rebuilt and the city will be in darkness until the dam is completed.

MIDLAND, MICH.—Surveys of the Chippewa River are being made by H. von Schon, of Detroit, for the purpose of planning several power developments.

STANDISH, MICH.—The Citizens' Manufacturing Company is increasing the capacity of its plant and is installing generators, etc.

WINONA, MINN.—The La Crosse Water Power Company on July 1 closed its option for the purchase of the plant of the Winona Railway & Light Company, and will operate the system by electricity transmitted from its hydroelectric plant, now under construction at Hatfield, Wis. The Winona Railway & Light Company is planning to double track its street car lines and also build an extension at the West End to the new ball park.

MERIDIAN, MISS.—The Meridian Light & Railway Company has petitioned for an amendment to its charter, authorizing an increase of its capital stock to $2,000,000.

HOLDEN, MO.—The City Council has ordered a complete overhauling of the municipal lighting plant at a cost of about $6,000.

MAITLAND, MO.—The power plant of the Maitland Electric Light & Power Company has been destroyed by fire, entailing a loss of about $10,000.

WARRENSBURG, MO.—The Gas & Electric Development Company, of Philadelphia, has consummated a sale of the Magnolia Light, Heat & Power Company to Philadelphia parties. The new company will be known as the Warrensburg Light & Power Company and will be operated by the Gas & Electric Development Company. Extensive improvements are planned.

NEWARK, N. J.—Bids will be received until July 16 by the committee on repairs, heating and sanitation of the Board of Education, for furnishing material and installing an electric lighting apparatus in the South Eighth Street School. R. D. Argue is secretary of the board.

CHAMPLAIN, N. Y.—The application of the Champlain Electric Company for permission to increase its capital stock from $15,000 to $30,000 was denied by the State Commission of Gas and Electricity.

COEYMANS, N. Y.—The Town Board of Coeymans has awarded the contract for lighting the villages of Ravena and Coeymans to the Atlantic Light & Power Company for a term of five years. The company offers to furnish 30-cp incandescent lamps for $20 per lamp per year, and promises to furnish 50 lamps in Coeymans and 80 lamps in Ravena by Oct. 1. An action has been brought against the Town Board of Coeymans and the Atlantic Light & Power Company to enjoin them from executing the contract. The Upper Hudson Electric Company submitted a bid for $13 for each lamp. The Atlantic Company has no plant at the present time.

ELMIRA, N. Y.—The Elmira, Corning & Waverly Railway Company has secured franchises for the right of way through the towns of Chenango, Southport and Corning.

HEMPSTEAD, N. Y.—The State Railroad Commission has granted the Sea Shore Municipal Railway Company authority to construct a street railway from Hempstead through Rockville Center to East Rockaway, a distance of five miles.

NEW YORK, N. Y.—Announcement has been made that the New York City Railway Company is planning to electrify the old Belt Line car system on First Avenue.

NEW YORK, N. Y.—Bids will be received until July 15 (readvertisement) at the office of George B. McClellan, mayor, chairman Armory Board, for furnishing and installing electric lighting fixtures, etc., in the Twelfth Regiment Armory, Borough of Manhattan. Robinson & Knust, 164 Fifth Avenue, Manhattan, are the architects.

ONEIDA, N. Y.—The City Council has refused to grant a franchise to the Central New York Power Company, of Utica, to furnish elec-

tricity and gas in Oneida. The company offered to furnish electricity for 10 cents per kw-hour.

ONEIDA, N. Y.—The application of the Oriskany Hydro-Electric Company, which proposes to operate in the counties of Oneida, Madison and Chenango, for a certificate of authority to transact business, and for consent to issue first morgtage bonds to the amount of $400,000 was denied by the State Commission of Gas and Electricity.

OSWEGO, N. Y.—At an election held June 27 the citizens voted to purchase the property of the Country Club upon which to erect a power house in connection with the relocation of the high dam. The new power house will cost abut $75,000.

PORT JEFFERSON, N. Y.—The State Railroad Commission has granted the Suffolk Traction Company permission to issue a mortgage of $1,200,000.

PORT WASHINGTON, N. Y.—The Mineola, Roslyn & Port Washington Traction Company has been authorized by the State Railroad Commission to change its name to the New York & North Shore Traction Company, and to increase its capital stock from $150,000 to $1,250,000 and to issue a mortgage of $1,000,000.

ROCHESTER, N. Y.—The State Railroad Commissioners have authorized the Rochester, Scottsville & Caledonia Electric Railroad Company to increase its capital stock from $500,000 to $2,500,000.

ROCHESTER, N. Y.—The Rochester Railway Company is making arrangements to transform the old car barn of the Rochester Electric Railway Company in Charlotte into an auxiliary power house. It will be equipped with a 500-kw rotary converter, electricity for which will be supplied by the Rochester Railway & Light Company from its station at the lower falls.

UTICA, N. Y.—The State Commission of Gas and Electricity has granted the Utica Gas & Electric Company permission to issue $2,000,000 in bonds to pay for betterments heretofore incurred and in process of making upon the plant of the Utica company and its subsidiary companies.

CLEVELAND, OHIO.—The directors of the Cleveland, Southwestern & Columbus Railway Company have approved the proposal to purchase a controlling interest in the Mansfield Railway, Light & Power Company, of Mansfield. The two properties will not be merged, but will be operated as one system. A new power house will probably be built in Mansfield capable of furnishing power for both the city lines and the new interurban line now being built from Ashland.

COLUMBUS, OHIO.—Bids will be received until July 30 by the Board of Trustees of the Columbus State Hospital for furnishing and installing complete an engine, dynamo, switchboard and feed wires in the power house.

GROVE CITY, OHIO.—Proposals will be received until July 15 for lighting the streets of the city for the term of one year. William C. Merritt is city clerk.

TOLEDO, OHIO.—The County Commissioners have rejected all bids received on June 26 for the construction of the power house at the County Infirmary, as all were in excess of the engineers' estimate, which is $27,000.

OKLAHOMA CITY, OKLA.—The Oklahoma City Street Railway Company has decided to erect its own power house at a cost of about $175,000. The equipment will consist of four 400-hp boilers and two 1600-hp engines. The engines will be direct connected to generators of 21,200-kw capacity. Provision will be made to double the capacity of the power house at any time, and with the additional installation provided for it is designed to handle the Oklahoma City & Guthrie street railways in connection with the interurban line.

HILLSBORO, ORE.—The City Council has granted a franchise to the Oregon Electric Railway Company to pass through the city on Base Line Street, and has also granted the United Railways Company a franchise by the way of Main Street, with the right to use either First, Second or Third streets for connection with the southern limit of the city.

MOSQUITE, ORE.—The board of directors of the Snake River Irrigation District has authorized an issue of bonds for $325,000 to build a complete pumping plant for irrigation of the district. Bids are now being asked for for both bonds and the plant. Bids on the plant will be opened July 30.

PORTLAND, ORE.—The Government Forestry Service has granted a permit to the Southern Pacific Company, of Kentucky, to construct a dam, conduit and power house in the Cascade forest reserve, for the purpose of generating electric power for general commercial use.

ALLENTOWN, PA.—The officers of the Allentown & Reading Traction Company have decided to place an additional engine of 300 horsepower in the power house at Griesemersville.

CHESTER, PA.—The Philadelphia Rapid Transit Company is making arrangements to construct a double track system from Cardington to Collindale. It is also said that the company is contemplating extending its line to Upper Darby township into the borough of Clifton Heights, thence to Alden Borough, continuing to Collindale.

ROYER, PA.—W. H. Bridenbaugh, representing J. W. Luther, of Indiana, is negotiating for the purchase of the water rights of Piney Creek. It is said that Mr. Luther is promoter of the company, which plans to erect a large plant and supply electricitiy for light and power in Williamsburg and Martinsburg and the intervening country.

SCRANTON, PA.—It is reported that the Central Railroad of New Jersey is considering the question of establishing the third-rail system on its line between Scranton and Mountain Park for the purpose of handling its large summer excursion traffic.

SHARON, PA.—The New Castle & New Wilmington Electric Railway is contemplating extending its line to Mercer and Grove City.

WASHINGTON, PA.—The County Commissioners have decided to abandon for the next five years at least, the heating and lighting plant in the new county jail. The commissioners have awarded the contract for furnishing light, heat and power for the court house and county jail to the Washington Electric Light & Power Company. The contract is for a term of five years to date from Aug. 1, at $6,600 per year. In addition to this the county will have to pay an additional $1,000 this year for the installation of a large motor, which will be used to run the ventilating apparatus instead of the steam engine now in use. It is stated that it has cost the county more than $9,000 a year to maintain and operate the plant in the jail building.

PROVIDENCE, R. I.—The Board of Aldermen on July 1 passed over the mayor's veto the ordinance granting the Providence Telephone Company an exclusive franchise for six years.

ANDERSON, S. C.—Hugh McRae, of Hugh McRae & Company, of Wilmington, N. C., has recently been in the city to complete arrangements for the development of the Cherokee Falls, four miles below Greggs Shoals, on the Savannah River. Work will commence at once on the construction of the dam, which, when completed, will furnish 10,000 horse-power. The company will be known as the Calhoun Falls Power Company and will be capitalized at $8,500,000.

NEWBERRY, S. C.—The City Council has granted a franchise to the South Carolina Public Service Corporation to construct and operate an electric street railway on several streets of this city.

SIOUX FALLS, S. D.—H. M. Byllesby & Co., of Chicago, Ill., have been retained as consulting engineers to make plans for the reconstruction and extension of the existing hydraulic plants of the Sioux Falls Light & Power Company. About $15,000 will be expended in rebuilding the present dams and in adding new equipment.

BRISTOL, TENN.—The Bristol Street Railway Company has been granted a 30-year franchise to build and operate a street railway system in Bristol.

CHATTANOOGA, TENN.—The Chattanooga Electric Company is now furnishing the Chattanooga Railways Company with electricity for operating its system. The Ridgedale power plant of the railway company will be closed down and hereafter will only be used in case of emergencies. The present equipment of the plant of the electric company consists of three 500-kw and one 1000-kw steam turbines. In addition the company has received a 500-kw turbine which will soon be placed and has also ordered a new 1000-kw machine to be installed in the plant. The company will also install boilers of 1640 horse-power to furnish power for the new 500 and 1000-kw turbines.

LAWRENCEBURG, TENN.—Plans are being prepared by Walter G. Kirkpatrick, of Jackson, Miss., for a municipal power plant consisting of concrete dam, turbines, transmission and distribution lines, arc lamps, dynamos, electric pumping, steel towers, tank and water mains.

SPARTA, TENN.—At the municipal election held June 27 the proposition to issue $40,000 in bonds to construct an electric light and water works plant was defeated by a vote of 95 to 18.

AMARILLO, TEX.—At an election held recently the citizens voted to grant a telephone franchise to H. H. Davenport & Co., of Hillsboro. The new franchise runs for 30 years and binds the company to install a system at a cost of $100,000.

BROWNSVILLE, TEX.—An election will soon be held to vote on the proposition of issuing $70 000 in bonds for the construction of waterworks and electric light plant. W. P. Bullock, of Kansas City, Mo., is engineer.

DALLAS, TEX.—It is stated that the contract for the construction of the power house of the Sherman-Dallas Interurban Railway at McKinney will soon be awarded.

WACO, TEX.—The City Council has granted Joseph Henry, of Denver, Col., a franchise to construct and operate an electric light and power plant in this city.

OGDEN, UTAH.—The City Council has passed an ordinance providing that the committee on electric lighting be given authority to make arrangements to secure water power site and rights.

PETERSBURG, VA.—At a meeting of the City Council held July 2, the gas and light committee's report, recommending a three-year contract with the Virginia Passenger & Power Company, for street lamps, at the prevailing rate of $57 for each lamp per year, was adopted. The proposed contract provides for a two-year extension, but the company has been authorized by the court to make a five-year contract, and the receivers will have to secure its authority to make a new contract.

BELLINGHAM, WASH.—Engineers of the Cascade Valley Railway Company are working on the final location of its line through the Cascade Pass. W. A. C. Rouse, president of the company, states that work will commence on construction of the road within 60 or 90 days.

CHEHALIS, WASH.—Application has been made to the City Council by J. B. Weeks, of Tacoma, for a 50-year franchise for the Centralia-Chehalis Electric Railway & Power Company.

SPOKANE, WASH.—The Panhandle Railway & Power Company is making surveys for the new electric railway which it proposes to build to Priest Lake.

TACOMA, WASH.—It is reported that the Great Northern Railroad Company will be operating its trains by electricity before the end of 1909. Work has commenced on the construction of a large power plant on Stave River, 35 miles from Vancouver, capable of developing 300,000 horse-power. Besides supplying electricity for operating the trains of the Great Northern Railroad the promoters expect to furnish electricity for commercial purposes in the Puget Sound cities.

STRATHCONA, ALB.—The City Council has practically decided to grant a long-term franchise to the Strathcona Radial Company to build an electric railway in this city and to adjoining places. The company has made arrangements to make connections with the Edmonton municipal system now being built.

KAMLOOPS, B. C.—The city clerk writes that the city expects to enlarge the electric light plant and is making inquiries in regard to producer gas plants.

HAMILTON, ONT.—The lighting committee of the Board of Works has decided to receive bids until about Aug. 1 for street lighting.

INGERSOLL, ONT.—The new owners of the Woodstock, Thames Valley & Ingersoll Electric Railway Company are contemplating the construction of the electric railway between Ingersoll and Woodstock.

DESCHENES, QUE.—G. Gordon, superintendent of motive power, of the Hull Electric Company, writes that the company is installing an additional generator and making other improvements to its plant.

New Industrial Companies.

THE AMERICAN ELECTRICAL DEVELOPING COMPANY, of Amsterdam, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical apparatus. The directors are: R. T. Ford, of Rochester; T. J. Murphy, of New York, and Richard Murphy, of Amsterdam.

THE COOLEY ELECTRICAL CONSTRUCTION & SUPPLY COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $2,000. The directors are L. H. Cooley, H. H. Cooley, of Rochelle Park, N. J., and J. H. Hendrick, of New York, N. Y.

THE DANNER ELECTRICAL COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000. The directors are Paul de K. Chesnaye, of New York; H. C. Hepburn and E. M. Post, of Babylon, L. I.

THE DECATUR HOME TELEPHONE COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $300,000. The purposes of the company are to make, license, lease, etc., telephonic and telegraphic appliances and apparatus of all kind. The incorporators are C. N. King, G. H. Russell and J. B. Messler.

New Incorporations.

HUNTSVILLE, ALA.—The Central Texas Telephone Company has been organized with a capital stock of $50,000 by A. B. Foster and others.

LOS ANGELES, CAL.—The Washington Electric Water Heater Company, of Los Angeles, Cal., has been incorporated with a capital stock of $200,000 by J. N. Winger, G. N. Turner and W. A. Sewright.

PUEBLO, COL.—Articles of incorporation have been filed for the Canon City, Pueblo & La Junta Railway & Power Company, with a capital stock of $200,000, by Francis James, Andrew J. Behymer and others.

WILLOWS, CAL.—The Snow Mountain Electric Power Company has filed articles of incorporation, with a capital stock of $500,000. The directors are: Charles H. Glenn, C. R. Wickes, A. S. Lindstrom, of Willows; B. H. Burton, T. Harrington, M. J. Boggs and H. C. Stovall, of Colusa. The company has been organized to develop a hydroelectric power plant on the Middle Fork of Stony Creek. Willows will be the principal place of business.

CAIRO, ILL.—The Cairo Terminal Traction Company has been chartered to build a railway from Cairo to the north line in Pulaski County. The incorporators and the first board of directors are L. E. Fischer, of Danville; D. Hogan, Mound City; W. S. Dewey, D. H. Sawyer, and H. F. Vogel, of Cairo.

CHICAGO, ILL.—The Homer Roberts Telephone Company has been incorporated with a capital stock of $500,000 by Joseph C. Belden and others.

CHICAGO, ILL.—Articles of incorporation have been filed for the Midland Telegraph Company, with a capital stock of $15,000. The incorporators are Nathan S. Smyson, John A. McKeown and F. W. Raymond.

LAWRENCEVILLE, ILL.—The Farmers' Telephone Company has been incorporated, with a capital stock of $2,500, by W. F. Foster, C. F. Breen and M. G. Couch.

QUINCY, ILL.—The Quincy Interurban Company has been incorporated, with a capital stock of $25,000. The directors are: Henry F. Dayton, J. Henry Bastert, Ezra Best, John J. Fisher, W. T. Duker, John S. Cruttenden and August R. Dick.

ROCK GROVE, ILL.—The Rock Grove Farmers' Mutual Telephone Company has been incorporated with a capital stock of $1,200. The incorporators are Lewis E. Rote, William Fisher and Martin Probst.

GERMANY, IND.—The Germany Mutual Telephone Company, of Fulton County, has been organized to construct and operate telephone lines and exchanges in Germany and Fulton County. The officers of the company are: Isaac L. Babcock, president; George Beeler, vice-president, and Frank Leiter, secretary.

WOLF LAKE, IND.—The Farmers' Mutual Telephone Company has been incorporated to construct a telephone system with an exchange in this town.

TULSA, I. T.—The Tulsa Electric Light Company has been incorporated with a capital stock of $15,000 by R. D. Campbell, D. M. Martindale, of Tulsa, and H. F. Burt, of Oklahoma City, Okla.

DALLAS, IA.—The Dallas Mutual Telephone Company has been incorporated with a capital stock of $1,000 by H. E. Willis and others.

MENLO, IA.—The Jefferson Mutual Telephone Company has been incorporated, with a capital stock of $10,000, by M. R. Cline, L. E. Smith and C. Wilson.

OAKLAND, IA.—Articles of incorporation have been filed for the Betna Valley Farmers' & Merchants' Mutual Telephone Company, with a capital stock of $15,000. Joshua H. Spalti is president.

PERSIA, IA.—The Persia Mutual Telephone Company has been formed with a capital stock of $10,000.

FRANKFORT, KY.—The Barren River Telephone Company, of Barron County, has been incorporated with a capital stock of $300 by Emmet G. Logan, Frank P. Hayes and G. W. White.

HOPKINSVILLE, KY.—Articles of incorporation have been filed for the Pembroke Home Telephone Company, with a capital stock of $40,000, by R. E. Cooper and others.

MOUNTAIN GROVE, MO.—The St. Louis, Mountain Grove & Southern Railway Company has been chartered, with a capital stock of $300,000 to build a railway from Mountain Grove to Bryant Creek, a distance of 30 miles. The directors are: J. J. Hedges, J. H. Jarrett, E. L. Richardson, of Springfield; J. Allhands, of St. Louis, and P. M. Johnston, of Elmo, Ill.

RENO, NEV.—Articles of incorporation have been filed for the Interurban Electric Railroad Company with a capital stock of $100,000 by Walter Wright, Louis Berrum, J. L. Robinson, O. M. Clifford, George W. Perkins, John Guilding and W. F. Webster.

BARRYVILLE, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Empire & Keystone Telephone Company. The company is capitalized at $10,000 and the incorporators are: Alonzo A. Calkin, Monticello; William H. Wilson, Eldred; Fred F. Freeman, Berryville, and others.

EARLVILLE, N. Y.—The Earlville Electric Light Company has been incorporated, with a capital stock of $10,000, by Guy H. Clark and others.

LONG EDDY, N. Y.—The Delaware & Sullivan Telephone Company has been incorporated with a capital stock of $10,000 by J. T. Male and others.

BERLIN CENTER, OHIO.—The Berlin Center Telephone Company has been incorporated with a capital stock of $10,000 by W. K. Hughes and others.

DEFIANCE, OHIO.—The Defiance, Hicksville & Fort Wayne Railway Company has been incorporated, with a capital stock of $10,000, by W. E. Golding, H. C. Eflert, M. O. Topliff, E. A. Murphy and M. I. Brown. The road will be operated by electricity.

SYLVANIA, OHIO.—The Citizens' Telephone Company, with a capital stock of $10,000, has been incorporated by F. J. Maisen and others.

Legal.

LIGHTING BONDS.—In a friendly suit which was instituted by the City of Redlands and its trustees against the city treasurer, A. E. Brock, the California Supreme Court rendered a decision affirming the validity of a bond issue of $50,000, the proceeds to be applied to the electric lighting of the city during the year of 1907. The treasurer alleged that the bonds were illegal, for the reason that the bonds that were to be used was not among those for which municipal corporations were authorized to borrow the money. The court holds otherwise and commands the city treasurer to sign bonds.

LIABILITY OF OWNER OF ELECTRIC WIRE TO POLICE OFFICER WHO COMES IN CONTACT THEREWITH ON ROOF OF BUILDING, WHILE IN THE DISCHARGE OF HIS OFFICIAL DUTY.—A police officer of the city of Greenville, Tex., went to the top of a building in the night time for the purpose of discovering who, if any one, was engaged in a room in an adjoining building in the offense of gaming. While thus in pursuit of the functions of his office he came in contact with a primary wire belonging to the defendant and was injured. The wire in question carried a current of 1000 volts or more and the insulation had been allowed to rot and wear off. The defendant contended that its act in maintaining the wire in a defective condition at the place described could not be regarded as actionable negligence, because an injury to the plaintiff at the time and in the manner set forth could not have been anticipated or foreseen. But this was held not to be an available defence. The plaintiff was on the building in the discharge of an official duty and for the purpose of apprehending suspected violators of the law, and he was in no way a trespasser. It was held that the defendant was liable in damages. City of Greenville vs. Pitts, Court of Civil Appeals of Texas, 102 S. W. Rep. 451.

RIGHT TO A TRADE SECRET.—Last week, in a decision reversing the lower court in the case of the Vulcan Detinning Company against the

American Can Company, the Court of Errors and Appeals of New Jersey has carried the principle of the responsibility of an employee to keep inviolate the secrets of his employer one step further than it has ever gone before in the eyes of the law, making the responsibility involuntarily to extend to whoever hires away the possessors of the private knowledge. The litigation arose out of the use by the American Can Company of a process of separating and recovering tin and steel from tin cans and waste scrap which the Vulcan Detinning Company claimed to own. The New Jersey Court in its finding holds that the former employees of the Vulcan Company who received knowledge of the secret process in confidence became its trustees, with all the duties and obligations of such a position. By employing these men with the knowledge that they possessed the Vulcan Company's secret, the court contends that the American Can Company also became responsible and put itself in the peculiar position of trustee for its rival. The American Can Company is not only permanently enjoined from proceeding with its detinning operations, but it is ordered to account to its rival for all of the profits it has made out of the detinning plants up to date.

RIGHT TO USE PATENT TROLLEY SWITCHING DEVICE IN CONNECTION WITH ELECTRIC LOCOMOTIVES NOT FURNISHED BY PATENTEE.—The General Electric Company, to whose rights the plaintiff company succeeded, sold to the Illinois Telephone Construction Company, in 1903, twenty-two electric locomotives. Upon the delivery of one of the locomotives the discovery was made that there was no practical overhead switch for the trolleys and that one was required in order to operate the locomotives automatically. The Illinois Company was engaged in operating trains in tunnels under the streets of the city of Chicago, and to be required to switch the trolley from one line to another by hand would have been a serious impediment to the running of trains. After many experiments a system was hit upon by which the trolley could be automatically switched from one line to another, correspondingly with the switching of the car. A patent on this device was secured and the present suit was brought to restrain the tunnel company from using certain other electric locomotives, previously purchased from another manufacturer, in connection with the device. It was held that, as there was no restriction in the contract of sale, the tunnel company could use the switching device, not only with the locomotives bought of the General Electric Company, but as well with others bought from other makers, and that the seller could not claim that such use amounted to an infringement of his patent rights. Thomson-Houston Electric Company vs. Illinois Telephone Construction Company, United States Circuit Court of Appeals, 152 Fed. Rep. 630.

NEGLIGENCE OF ELECTRIC LIGHT COMPANY IN PLACING HIGH-TENSION WIRES TOO CLOSE TOGETHER AND IN NOT PROPERLY INSULATING A QUESTION FOR THE JURY.—D. L. Brooks, an experienced lineman in the employ of the Western Union Telegraph Company, wos ordered to string some wires for the company on a pole at the corner of Main and Calhoun streets in the city of Memphis, Tenn. On the same pole were two wires belonging to the Memphis Consolidated Gas & Electric Company, the pole standing between the two wires, which were about eighteen inches apart. One of the wires was spliced at a point near the pole and the insulating tape had worn away. The lineman, while at work, received a shock of electricity, which threw him from the pole and resulted in his death. No one witnessed the accident, but there was evidence tending to show that the shoulder of the deceased touched the exposed wire of the Memphis company while his foot was resting upon a grounded telephone wire attached to the pole about five feet lower down. In an action against the Memphis company the negligence charged against the defendant was in placing the high-tension electric light wires too close together on the pole, in not properly insulating them, and in failing to inspect them so as to keep them in a reasonably safe condition. In the lower court the question of negligence was left for the determination of the jury and a verdict against the company was brought in. Upon appeal to the United States Circuit Court of Appeals it was held that the question was a proper one for the jury and the judgment against the defendant company was affirmed. The defendant claimed that the lack of insulation at the point where the wire was spliced was immaterial because it is impossible to effectually insulate a high-tension wire of the kind in question and the deceased had been instructed to regard all such wires as live wires, and as if no attempt had been made to insulate. But in view of the fact that such wires are required to be insulated, and that in this case an attempt to insulate had been made, the court was of the opinion that it was for the jury to say whether or not the defendant had been unmindful of its duty to exercise proper care. Memphis Consolidated Gas & Electric Company, 152 Fed. Rep. 677.

Obituary.

MR. J. C. SNYDER, chief engineer of the Great Western Power Company, Oroville, Cal., died recently after an illness of nearly two weeks with tubercular meningitis. He was only 35 years of age. Although a young man, he had made an enviable reputation in his profession. He had gained a high standing among the engineers of the country as was shown by his selection to direct the construction of one of the greatest power plants in the warld. His death is a great loss to the Great Western Power Company. The deceased was warmly regarded by all who met him and held in high esteem by all acquaintances. His father, H. W. Snyder, lives at Harrisburg, Pa., but was able to arrive in time to spend the last few hours with his son. In his great grief he has the sympathy of the community. The remains will be taken East for burial.

MR. L. J. MAGEE.—We record with profound regret the sudden death in New York City from apoplexy, on July 2, of Mr. Louis Jones Magee, a distinguished electrical engineer. He was born in Malden, Mass., in September, 1862, and was graduated from Wesleyan University in 1883. He entered the shops of the Thomson-Houston Company at Lynn and then went to Lima, Peru, where he installed several electrical illuminating plants. When he returned he became more closely associated with the Thomson-Houston Company as its representative to Europe, where he constructed its first electric tramway on the Continent. In Berlin he organized and became the resident manager of the Union Elektricitats-Gesellschaft. Three years ago he returned to this country, and he has since represented the consolidated Allgemeine Elektricitats-Gesellschaft as resident director here. Meantime he has been a frequent contributor to the engineering press. In 1894 he married Miss Virginia P. Kent, of Berlin, who survives him. His mother, Mrs. Mary Magee, 86 years old, is living at Malden. Mr. Magee was a member of the American Institute of Electrical Engineers and of the Engineers' and Lawyers' clubs.

Personal.

MR. GILBERT ROSENBUSCH, of the Underground Electric Railways Company of London, Ltd., sailed from Liverpool for New York on the *Adriatic*, July 3, to study the latest developments in electric traction work.

MR. P. G. WATMOUGH, JR., consulting electrical engineer, New York, advises us that he has lately been occupied in straightening out various matters in the Elberon plant of the New Jersey Consolidated Water & Light Company.

COMMISSIONER SAGUE, of the Public Utilities Commission of New York, has been made chairman of the committee on instructions for the expert attachés, and Mr. C. D. Barnes, electrical expert of the old Railroad Commission, has been retained.

MR. T. N. VAIL.—At a meeting of the board of directors of the New York Telephone Company last week Mr. Theodore N. Vail was elected president to succeed Charles F. Cutler, deceased. Mr. Vail is president of the American Telephone & Telegraph Company.

MR. HENRY C. HIGGINS, manager of the Sterling, Dixon & Eastern Electric Railway, of Dixon, Ill., and also manager of the Lee County Lighting Company, has resigned both positions. He will be succeeded by Mr. Edward B. Kirk, of Oshkosh, Wis., vice-president and general manager of the Winnebago Traction Company.

MR. CHARLES S. POWELL has resigned as general agent of the Westinghouse Electric & Manufacturing Company, with headquarters in New York City, and with his resignation the position has been abolished. Mr. Powell has made no definite plans for the future, but expects to be in New York for the next two or three months.

MR. GEORGE B. FOSTER has taken the management of the Power Improvement Company, which on July 1 opened an office at 2018 Fisher Building, Chicago, to handle De Laval steam turbines, generating units and centrifugal pumps, and the Wilkinson mechanical stoker. Mr. Foster is well known in Chicago through his many years' connection with the Bullock and Wagner companies.

MR. C. W. HUMPHREY, formerly engineer and manager of the Northern Colorado Power Company, has opened an office for consulting practice in all branches of electrical engineering work in The Rookery, Chicago. Mr. Humphrey was also formerly engineer for the Denver Gas & Electric Company, and has had considerable experience in electric power plant work in Denver and vicinity.

MR. J. E. LYONS, chief engineer of the Cleveland, Painesville & Eastern power plant at Willoughby, Ohio, has been promoted to the position of superintendent of power and cars, to take effect July 1. Mr. Lyons was master mechanic of the East Cleveland Railway Company for five years, and was with the Cleveland City Railway Company for one year in the same capacity. He has been with the C. P. & E. R. R. Company for 11 years.

MR. A. C. WILLARD, consulting mechanical engineer, advises us of the opening in the National Metropolitan Bank Building, Washington, of a firm of associate engineers, of which he is a member. Mr. Philander Betts is the member for electrical engineering and Mr. S. H. Woodbridge for heating and ventilation in the Southern states exclusively. The chief purpose is the equipment of buildings, but general consultation work in mechanical and electrical engineering will be undertaken.

MR. HIRAM PERCY MAXIM will resign his position as chief engineer of the Electric Vehicle Company on August 1, having held that important position for many years. He does this to take up some new developments which cannot be made public at the present time, but regarding which full details will be announced in the fall. His headquarters will remain at Hartford, Conn., where he will open an office. Since 1895 Mr. Maxim has played a very prominent part in the development of American automobiles, and has left his mark on the Columbia types, both gasoline and electric. He has been chairman and member of several important technical committees on automobile improvement.

MR. RALPH D. MERSHON sailed July 2 on the Cunard steamer *Caronia* for England on his way to South Africa in connection with the work of the Victoria Falls Power Company. He expects to be absent from this country about 100 days. He will meet in South Africa a number of the directors and officials of the Victoria Falls Power Company, and Mr. Arthur Wright, of London, who is directly responsible for the

engineering of the steam stations which the power company is installing on the Rand. Mr. Mershon will be in consultation relative to the location of the steam stations and as to the local distribution circuits. He will go from Johannesburg to Victoria Falls, passing on the way through the country in which will be located the transmission line from Victoria Falls to Johannesburg and the Witwatersrand.

MR. C. D. McKELVEY.—Mr. Charles D. McKelvey, of Paterson, has been appointed inspector of railroads by Joseph W. Congdon, president of the Board of Railroad Commissioners of New Jersey. Mr. McKelvey has had long experience in many kinds of railroad work, and is particularly well equipped for his duties. He began as a telegraph operator in a country station. Then he was successively brakeman, conductor, train dispatcher and station agent on the Erie, after which he became general superintendent of the New Jersey Midland, serving as such until 1889, when he went to the New York Central to take charge of the Grand Central Station. About a year later he resigned to build the Edgewater tunnel. Subsequently he had charge of the construction of the Wilkes-Barre & Eastern Railroad. He next served with the New York, Susquehanna & Western Railroad, being its general superintendent for nine years. He served last year on the Finance Commission of Paterson and as president of the Board of Public Works of that city.

Trade Publications.

SPARKING COILS.—The Autocoil Company, 136 Seventh Street, Jersey City, N. J., has issued a sheet containing illustrations of its "08" hard-rubber unit autocoils.

ELECTRICAL INSTRUMENTS.—Queen & Company, Philadelphia, have issued a large sheet hanger in colors illustrating a number of testing sets, which together cover the entire field of electrical testing.

THERMIT STEEL FOR WELDING.—This is the title of a recent publication of the Goldschmidt Thermit Company, of New York, N. Y., issued to give more specific information regarding the use of thermit in making repairs. Prices are also included of thermit and accessories.

PORTABLE ELECTRICITY.—With this title, Harvey Hubbell, Inc., Bridgeport, Conn., has issued a well illustrated catalogue describing the various types of Hubbell attachment plugs and showing some of their applications in household use. One cap fits all the Hubbell attachment bases, which are made for cord suspensions, chandeliers, wall brackets, floors, walls, etc.

STEAM POWER PLANT ECONOMY.—Chas. C. Moore & Co., of San Francisco, have issued for free circulation a pamphlet entitled "A Method of Calculating Steam Power Economy," containing a comparison of economies with steam and electrically driven auxiliaries, initial cost of plant under Pacific Coast conditions, and total cost of power with special reference to the use of oil fuel.

FUSES, BASES, ETC.—The Chase-Shawmut Company has just issued to the trade a very attractive 58-page booklet, pocket size, covering its complete line of fuses, bases and fittings. In addition to its regular line, this catalogue presents a number of specialties which have recently been placed upon the market. Containing over one hundred illustrations and considerable valuable data, this catalogue will be eagerly sought by all interested in this class of material.

WARREN ALTERNATORS.—The Warren Electric Manufacturing Company, Sandusky, Ohio, in Bulletin No. 30, illustrates and describes the Warren revolving-field alternator, which is made for generating single-phase, two-phase, or three-phase currents. Owing to the spacing of the coil slots, a customer who purchases, for example, a single-phase, 85-kw alternator can at any time convert it into a 100-kw, 2 or 3-phase machine, by merely changing the armature coils. Machines of 100-kw, 200-kw, and 300-kw, 60-cycles, are illustrated, one of the latter being shown in the Bay City, Mich., municipal electric light station.

OERLIKON PUBLICATIONS.—Among recent publications of the Maschinenfabrik Oerlikon, Zurich, Switzerland, which are always excellent in matter and execution are the following quarto pamphlets: A 54-page pamphlet describing and illustrating the Caffaro-Brescia generating and transmission plant; one of 34 pages devoted to an elaborate account of an electrolytic method for the production of hydrogen and oxygen from water; and a 26-page pamphlet giving in detail the methods and results of tests of the electrical machinery built for a 50,000-volt Italian transmission line. Recent Oerlikon bulletins describe the steam turbine supplied to the Central Electric Company of London, and a new railway motor. A bulletin gives the results of operation of a Swiss electric railway and another relates to the details of tests for high-voltage apparatus.

MECHANICAL DRAFT.—Several mechanical draft plants of large size are described in a booklet recently published by the Green Fuel Economizer Company, of Matteawan, N. Y. A pair of fans supplied to the East St. Louis & Suburban Railway are said to be the largest ever built with overhung wheels, the wheels measuring 19 ft. 6 in. in diameter, by 7 ft. wide at the tips of the blades and being driven by Corliss engines. Photographs are shown of nearly a dozen other large plants and also drawings and lay-outs of a number of large and interesting installations, including the new Hoboken terminal of the Lackawanna Railroad. A portion of the book is devoted to the Green Fuel Economizer, which is often put in with mechanical draft fans because they both are beneficial under similar conditions and complementary in promoting fuel economy.

LIGHTNING ARRESTERS.—A new line of alternating current lightning arresters has been developed during the last year by the General Electric Company, and is described in Bulletin 4511 just issued. These lightning arresters are designed to First, discharge potentials moderately higher than the potential of the circuit protected. Second, restrain the flow of the dynamic current across the gaps and extinguish the arc when normal potential is restored. Third, discharge high potentials covering a wide range of frequency. Fourth, prevent excessive rises of potentials between lines as well as between lines and ground. These, like previous lightning arresters made by this company, are an elaboration of Prof. Elihu Thomson's fundamental patents; and investigations and experiments of the past year have suggested certain improvements which are described in the bulletin. The lightning arrester consists in general of a number of spark gaps, some of which are shunted by resistance rods. In this way, selective paths are formed and these are so designed as to give the arresters a uniform voltage breakdown regardless of the frequency or quantity of discharge. Diagrams of connections are shown, and different styles of disconnecting switches, choke coils, etc., are illustrated.

NATIONAL ELECTRIC LAMP ASSOCIATION BULLETINS.—The National Electric Lamp Association has issued a series of eight bulletins for circulation among architects, building contractors, illuminating engineers, electrical engineers, college professors, students, mechanical engineers and civil engineers, members of electrical associations, members of electrical societies, etc. Two of these give a brief description of the National Electric Lamp Association and its engineering department, where the lamps from all companies composing the Association are sent to be subjected to every conceivable test. Two bulletins treat of the "Gem" metallized filament lamp, and include a general description of the lamps, characteristics of the lamp as to operation, power consumption, quality of light, adaptability, simplicity of operation, etc. Cuts of the lamps with various Holophane reflectors are given, together with the vertical distribution curves of the lamps in units. Tables show the actual cost of operating the various types of lamps for 1000 hours on various costs of power. The tantalum lamp is described in another bulletin. Vertical distribution curves are given and also tables of the comparative cost of operating carbon "Gem" metallized and tantalum filament lamps showing the advisability of substituting tantalum lamps for the less efficient type where the cost of power is high. Two bulletins are devoted to the tungsten filament lamp. These lamps are at present on the market only in the 40 and 60 cp street series form but may be soon manufactured for multiple service. "Data on Illumination" is the title given to Bulletin No. 7, which gives a number of points to be considered in designing illumination, on methods of illumination and measurement of light. Tables are given showing the intensity of light sources in candle-power per square inch, color of common illuminants, effect of colored lights on various colors, required illumination for various classes of service and increase of illuminations for various colored walls. Cuts of several of the lamps are given in connection with their vertical distribution curves, and a table gives the intensity of illumination in foot candles produced at various points in horizontal planes by a light source of one candle-power, and also the angle made by the light ray and a line perpendicular to the horizontal plane. As an aid to those computing lighting circuits a table is given showing the current taken by various lamps, together with wiring tables and proper formulæ for computation. The Engineering Department of the National Lamp Association, 4411 Hough Avenue, Cleveland, Ohio, will place anyone interested on the permanent mailing list for bulletins on incandescent lamps and illumination.

Business Notes.

THE LORD ELECTRIC COMPANY has moved its office, factory and construction department to 213 West Fortieth Street, New York City, where it has improved facilities for transaction of business.

VAN DORN.—The Van Dorn-Elliott Electric Company has changed its name to the Van Dorn Electric & Manufacturing Company, and has increased the capacity of its plant. It has added a new department, which will be devoted to the manufacture of tools, particularly electric drills and reamers.

EDISON BATTERIES.—The Edison Manufacturing Company has received a letter from Mr. James Craig, the owner of the winning motor boat, "Ailsa Craig," in the recent race from New York to Bermuda, for the James Gordon Bennett cup, stating that the "Ailsa Craig" was equipped with Edison cells and spark-coil and that they served their purpose properly. The run was 771 miles.

CROCKER-WHEELER (Columbus, Ohio) OFFICE.—In order to handle the mass of business in electric generators and motors in southern Ohio, the Cleveland office of Crocker-Wheeler Company, of Ampere, N. J., has found it advisable to open a sub-office in the Columbus Saving & Trust Company Building, Columbus, Ohio. The sub-office will be in charge of Chas. W. Cross, formerly of the Cleveland office of Crocker-Wheeler Company.

SUBWAY CONTROLLING APPARATUS.—Mr. John C. Terry, sales engineer of the J. L. Schureman Company, Chicago, who is in charge of the New York branch of this company at 92 Chambers Street, New York City, has recently secured the contract for furnishing the controlling apparatus for the new tunnel of the Interborough Rapid Transit Company. The conditions to be met with in this installation are somewhat difficult and the contract was awarded after a most thorough investigation into the merits of the apparatus.

Weekly Record of Electrical Patents.

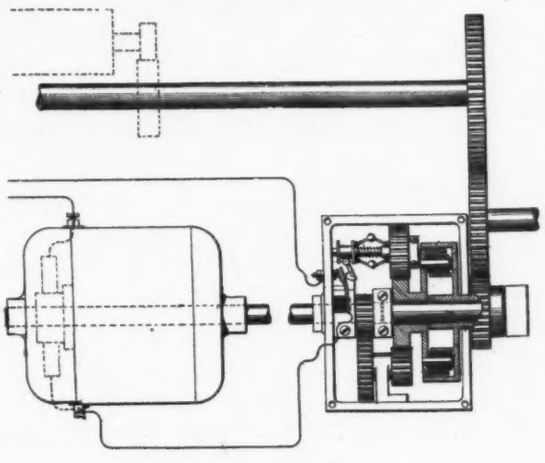
UNITED STATES PATENTS ISSUED JULY 2, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

858,363. TELEPHONE EXCHANGE; Clarence A. Anderson, Lindsburg, Kan. App. filed May 18, 1903. The combination with step by step mechanism, a propelling device therefor, and a holding pawl, of a magnet for releasing said mechanism from its holding pawl, and a normally open electrical connection for said magnet arranged to be closed by the forward movement of said mechanism and to be held during two or more steps thereof.

858,385. METHOD OF MAKING INSULATING TUBES; Emil Haefely, Basel, Switzerland. App. filed Sept. 26, 1904. Relates to method of manufacturing insulating tubes, and provides a machine having a roller with protuberances which contact with the tube in succession and compress its material into compact and durable form.

858,391. PRIMARY BATTERY; Charles E. Hite, Burlington, N. J. App. filed Dec. 23, 1905. Provides a battery or cell of compact form adapted to give a greater potential difference between its terminals than is now obtainable, and consists in bringing the elements close together and maintaining the electrolyte in such manner that it will be replaced by further electrolyte as fast as exhausted.



858,687—Ignition System for Explosion Engines.

858,392. PRIMARY BATTERY; Charles E. Hite, Burlington, N. J. App. filed Dec. 28, 1905. Relates to modifications of the above.

858,399. CONTROLLER; Michael Kelly, Hammond, Ind. App. filed Sept. 22, 1906. Provides an improved form of controller for dental motors adapted to rest upon the floor and be operated by the foot of the operator while the same foot is resting upon the floor.

858,400. ELECTRIC FURNACE PROCESS; Franz von Kugelgen and George O. Seward, Holcombs Rock, Va. App. filed Jan. 31, 1905. A furnace designed especially for the production of low carbons and carbon free metals, such as chromium, tungsten and molybdenum.

858,425. METHOD OF CONTROL FOR ELECTRIC MOTORS; Norman W. Storer, Pittsburg, Pa. App. filed July 24, 1905. Relates to the series parallel control of electric motors and is designed to limit the fluctuations in the amount of current required to the minimum which will permit the fulfillment of the required service conditions.

858,454. TELEPHONE SYSTEM; E. B. Heaford, Omaha, Neb. App. filed Dec. 31, 1906. In a telephone system, the combination with a central station, and a subscriber's station, of a cord circuit, a line circuit, a plug and jack for connecting the circuits, a signal controlling relay bridging the line circuit, a cut-off relay for controlling the said relay circuit, and a resistance and impedance circuit bridging the springs of the jack and inductively related to the cut-off relay.

858,468. CONTROLLING APPARATUS; Walter J. Richards, Milwaukee, Wis. App. filed April 11, 1904. Provides means for automatically regulating the operation of fluid pumps, especially in conjunction with air compressors when operated by means of electric motors.

858,469. FLUID-PRESSURE SYSTEM; Walter J. Richards, Milwaukee, Wis. App. filed Oct. 6, 1904. Relates to electrically driven fluid pumps, and particularly to the use of alternating currents for the purpose of supplying the necessary energy to the motor mains.

858,471. CONTROLLING APPARATUS FOR PRESSURE SYSTEMS; Walter J. Richards, Milwaukee, Wis. App. filed Jan. 3, 1905. Relates to modifications of the above.

858,474. ATTACHMENT FOR ELECTRIC METERS; William L. Saunders, Denver, Col. App. filed June 27, 1905. Relates to an attachment for electric meters and is designed to frustrate and detect any attempt made by unauthorized persons at tampering with exposed portions for so-called loop wires which extend from the wall to the electric meter.

858,476. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; Otto S. Schairer, Pittsburg, Pa. App. filed Aug. 2, 1905. Relates to systems of control for electric motors and particularly to means for limiting the amount of current that may be supplied to motors while accelerating in speed.

858,478. CONTROLLER FOR STORAGE BATTERIES AND SIMILAR PURPOSES; Frank L. Sessions, Columbus, Ohio. App. filed Oct. 29, 1903. Relates to improvements in the construction and arrangement of devices by which storage batteries are on one hand connected to the charging lines and on the other hand are subsequently connected to the motor to which they are to supply current.

858,481. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; Norman W. Storer, Pittsburg, Pa. App. filed July 24, 1905. Relates to systems of control for electric motors and particularly to such systems as operate to change the motors from series to parallel relation during acceleration.

858,507. PROCESS OF ELECTRIC WELDING; Weston M. Fulton and John S. Brown, Knoxville, Tenn. App. filed June 23, 1904. Relates to the electric welding of thin sheet metal. Consists in effecting an approximately uniform resistance to the electric current between the electrodes by continuously removing the scale from the surface of the electrodes and dressing or polishing said surfaces to evenness so as to continuously preserve uniformity of contact with the metal to be welded.

858,554. WIRELESS TRANSMISSION; Harold A. Yarnell, Los Angeles, Cal. App. filed Apr. 23, 1906. Relates to wireless transmission and provides means for eliminating the losses due to the ground connection heretofore employed and thus increase the efficiency of the system.

858,563. GALVANIC BATTERY; Benjamin J. Blameuser, Chicago, Ill. App. filed Jan. 20, 1906. Relates to improvements in galvanic batteries and more particularly to batteries in which depolarizing compounds are provided for combination with the nascent hydrogen evolved during chemical action.

858,569. SPACE TELEGRAPHY; Sewall Cabot, Brookline, Mass. App. filed Nov. 5, 1906. Provides a receiving system in which a plurality of oscillation detectors are associated with an elevated receiving conductor and in which by means of suitable apparatus and connections each one of a plurality of signaling devices may be associated with different oscillation detectors.

858,574. ALTERNATING-CURRENT RECTIFIER; William B. Churcher, Cincinnati, Ohio. App. filed Aug. 4, 1905. Provides mechanism for producing direct current of low voltage from a source of alternating current. Employs an electrolyte cell having lead electrodes in dilute sulphuric acid.

858,591. CIRCUIT-CONTROLLING MEANS; Ellsworth E. Flora, Chicago, Ill. App. filed Oct. 11, 1906. Relates particularly to means for controlling an electric circuit for any desired purpose as for instance the operation of a signal through the medium of said circuit.

858,606. INDICATOR; Earle L. Kelzer, Catella, District of Alaska, and Wesley P. Rodgers, Seattle, Wash. App. filed March 1, 1907. Relates to improvements in indicators for elevators and provides means by which the passengers of a car can make known to the operator or conductor the floors to which they desire to be conveyed without calling out the number as now practiced. Has a single signal lamp in the car and means for controlling it.

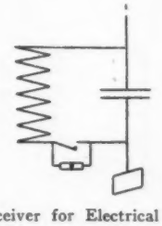
858,611. ELECTRICAL SIGNALLING APPARATUS; William W. Lovett, Los Angeles, Cal. App. filed Nov. 12, 1906. Relates to a complete portable telephone outfit for soldiers in which a cable is unwound from a reel at the back of the soldier as he advances.

858,621. PROCESS OF ELECTRICALLY REDUCING OXIDE ORES; Albert J. Petersson, Alby, Sweden. App. filed Oct. 30, 1906. Relates to a process of electrically reducing oxide ores or other oxides or combinations of oxides while using as a reducing agent carbon or carbonic acid obtained from the carbon of the charge.

858,622. METHOD OF CARRYING OUT METALLURGICAL REDUCTION AND MELTING PROCESSES; Albert J. Petersson, Alby, Sweden. App. filed Oct. 30, 1906. Relates to a method of reducing and smelting ores and the like in an electric furnace.

858,623. PROCESS OF CONTINUOUSLY PRODUCING CARBID FROM LIME AND CARBON; Albert J. Petersson, Alby, Sweden. App. filed Oct. 30, 1906. Relates to modifications of the above.

858,632. SYSTEM OF ELECTRICAL OPERATION; J. C. Slaughter. App. filed May 3, 1903. In a system of electrical operation, means for varying the field strength of an alternating current generator adapted to operate in unison with means for maintaining a predetermined voltage supply.



858,668—Receiver for Electrical Oscillations.

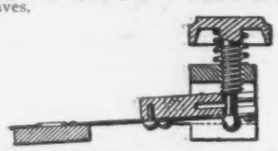
858,637. TELEPHONE ATTACHMENT; Wm. H. Stinson, De Funiak Springs, Fla. App. filed March 13, 1905. A device intended to be applied to a telephone call bell and having balls which are released whenever the bell rings.

858,668. RECEIVER FOR ELECTRICAL OSCILLATIONS; Peder O. Pedersen, Copenhagen, Denmark. App. filed June 28, 1906. A receiving apparatus for a wireless system comprising a circuit of vibration having inductance and capacity therein, said circuit having a contact device adapted to close the circuit of vibration directly at one position of its throw, and a divided circuit including a wave indicator and adapted to be included in the circuit at the other position of throw of said contact device.

858,676. SYSTEM OF ELECTRICAL OPERATION; Joel C. Slaughter, Dallas, Tex. App. filed March 12, 1903. Provides means whereby a saving will be effected in the power required to operate a generator during reduced loads thereby reducing the fuel consumption below that which would be required to operate the systems in use at present.

858,687. IGNITION SYSTEM FOR EXPLOSION-ENGINES; Richard Varley, Englewood, N. J. App. filed May 31, 1906. An arrangement for driving a dynamo from an engine for ignition purposes and including a centrifugal slipping device whereby a constant speed is maintained. There is also provided a safety device which opens the circuit in case the centrifugal slipping device fails to act.

858,688. VIBRATOR ADJUSTMENT FOR INDUCTION-COILS; Richard Varley, Englewood, N. J. App. filed Apr. 8, 1907. A means for permitting adjustment of the vibrating spring blade of an induction coil and which is automatically locked in any position to which it is set. Includes a provided member having a pair of resilient leaves and longitudinally adjustable means having shoulders embracing said leaves.



858,688—Vibrator Adjustment for Induction Coils.

858,699. OUTLET-BOX; Leon W. Bossert, Utica, N. Y. App. filed Feb. 10, 1906. Relates to features of construction of an outlet or junction box designed to meet the need for a shallow box for use in making connections from both sides of a partition for electric or gas lights.

858,700. OUTLET-BOX; Leon W. Bossert, Utica, N. Y. App. filed Apr. 25, 1906. Relates to modifications of the above.

858,718. ELECTRIC FURNACE; Paul L. T. Heroult, LaPraz, France. App. filed Apr. 18, 1906. Provides certain improvements in electric furnaces whereby the power factor (when an alternating current is used) is increased and whereby the resistance to the passage of the current is lessened.

858,720. SYSTEM OF ELECTRICAL DISTRIBUTION; Albert S. Hubbard, Greenwich, Conn. App. filed Feb. 21, 1903. Relates to improvements in systems of distribution, and particularly to a generating, storing or distributing system involving the use of a storage battery and booster.

858,732. TROLLEY-POLE-CONTROLLING DEVICE; William Lile, Venice, Ill. App. filed June 28, 1906. Provides mechanism which will permit the trolley pole to drop away from the trolley wire when the trolley jumps the wire instead of permitting the pole to swing or fly upward under the tension of the spring which keeps it in contact with the wire under general conditions.

858,734. MAGNETIC SEPARATOR; Thomas J. Lovett, Chicago, Ill. App. filed Oct. 9, 1906. Provides a magnetic separator having an armature formed of a plurality of independently wound comparatively short magnet sections placed side by side longitudinally of the axis of rotation and coupled either in series or in parallel, whereby the magnetic force is rendered substantially equal throughout the length of the sectional magnet.

858,739. COMBINED PORTABLE TELEPHONE AND TELEGRAPH INSTRUMENT; F. W. Medhurst, Tasmania, Australia. App. filed March 8, 1907. In a combined portable telephone and telegraph instrument, in combination, a high tension coil, an extra pole piece in said coil, and a reed, and means for altering the note of such reed.

858,767. SYSTEM FOR PARTY-LINES IN TELEPHONE EXCHANGES; J. M. Storkerson, La Crosse, Wis. App. filed Apr. 25, 1906. In a telephone system, a telephone line; a plurality of series of multiple jacks; a relay; a second relay; and signal receiving means; said first relay having contacts adapted to connect said line alternately to one of said series of multiple jacks or to said second relay, and said second relay having contacts adapted to connect said line alternatively to another of said series of multiple jacks or to said signal receiving means, substantially as described.

858,775. NIGHT-SERVICE ATTACHMENT FOR TELEPHONE-LINES; C. E. Ackerman, Vernon Township, Mich. App. filed Sept. 27, 1905. Details of circuits for party lines including doctor's station which may be signaled without disturbing the others.

858,780. ELECTRIC-FURNACE PROCESS OF MAKING LOW-CARBON METALS OR ALLOYS; Frederick M. Becket, Niagara Falls, N. Y. App. filed Jan. 30, 1906. A means for manufacturing low-carbon metals in electric furnaces in which the current is conducted to and from the charge by carbon or graphite electrodes. Provides electrodes of very small sectional area in proportion to the current which they carry, as compared to those generally employed.

858,793. RAILWAY-TRAFFIC-CONTROLLING APPARATUS; Clyde J. Coleman, Rockaway, N. J. App. filed Nov. 7, 1904. Relates to detail features of construction of a signaling system employing liquid or compressed carbonic acid gas to actuate the signals.

858,797. SYSTEM OF ELECTRIC CONTROL; Wolfgang E. Ebert, St. Louis, Mo. App. filed Dec. 1, 1905. Relates to a system of controlling electrical devices whereby a comparatively large number of such devices may be controlled from a distant point by a comparatively small number of mains.

858,846. HOUSE-WIRING CONDUIT SYSTEM; Harry Alexander, New York, N. Y. App. filed Mch. 22, 1906. Designed to provide a system of wiring a building which permits a wide range of flexibility, and which contemplates changes in the location of the circuits and devices, and which provides for an intercommunicating system throughout the various compartments in a building.

858,862. PRIMARY AND SECONDARY BATTERY; Thomas A. Edison, Orange, N. J. App. filed Jan. 10, 1906. An alkaline battery electrolyte containing an alkaline silicate, as set forth.

858,822. TELEPHONE STAND; William B. Oliver, Collingswood, N. J. App. filed Jan. 15, 1907. In a telephone support, the combination with a self-balancing standard, having an overhanging portion, of a spring actuated receiver hook mounted in said standard below said overhanging portion; and a transmitter casing pendulently connected to said overhanging portion.

858,909. ELECTRIC BELL; Nelson H. Raymond, Brooklyn, N. Y. App. filed Aug. 24, 1905. Relates to improvements in electrical apparatus, and particularly to a terminal construction for electric bells, etc. Provides means for supporting a contact terminal for an electric bell so that it will remain in place even though subjected to considerable vibration so that electric wires may be secured without derangement of the parts.

858,910. ARMATURE-BANDING APPARATUS FOR LATHES; Charles Remelius, New York, N. Y. App. filed March 22, 1907. Relates to lathe attachments by which binding wire is applied to an armature.

858,925. BURGLAR-ALARM; Carlos Van Bergh, Winnipeg, Manitoba, Canada. App. filed Dec. 22, 1906. Relates to a screen formed of dependent metallic conductors freely suspended closely adjacent to each other and so connected that the alarm will be set off by bringing any two adjacent conductors in contact with each other or by the cutting away or removal of the conductors.

858,941. ELECTROMAGNET; George Baehr, McKeesport, Pa. App. filed Apr. 4, 1907. Relates to electromagnets, and more particularly electromagnets for use in lifting or pulling iron pipes and rods. Has a magnet with its lifting face composed of a plurality of pole pieces of alternating polarity.

858,952. WIRE-CLAMP; George L. Carter, Yellow Springs, Ohio. App. filed Apr. 21, 1906. Relates to wire clamps for insulators and the like. A metallic clasp surrounds the body of the insulator and a pivoted loop or hasp closes down and clamps the wire on the upper surface of the insulator.

858,955. ELECTRICALLY-HEATED TOOL; Walter G. Clark, New York, N. Y. App. filed Oct. 6, 1906. Relates to improvements in electrically heated tools and especially a tool which is intended to carry a pen, electric contact or analogous metallic instrument in a convenient way so that the same may be quickly and highly heated and can be easily placed in or removed from the tool.

858,984. TELEPHONE TRANSMITTER; N. H. Holland, et al., Chicago, Ill. App. filed July 28, 1906. A transmitter comprising a diaphragm supported at its edges, a ring-shaped member bearing loosely upon the diaphragm inward of its support and adapted to receive vibrations from the diaphragm, a spring holding said member in position against said diaphragm and serving to stretch the portion of the diaphragm spanned by said member, and a microphone operated by said member.

859,011. ELECTROTHERAPEUTIC APPARATUS; Nelson H. Raymond, Brooklyn, and Joseph C. Vetter, Coney Island, N. Y. App. filed Aug. 24, 1905. Relates to electrical therapeutic apparatus having an electrode which is held in one hand and which may be moved from point to point as may be desirable.

859,018. TRANSPORTATION SYSTEM; Franklin S. Smith, Philadelphia, Pa. App. filed Nov. 21, 1906. Relates to railway or transportation systems in which electrical apparatus is placed along a roadway or track so as to be operative through other apparatus fixed to or carried by a car or vehicle to move the same along the track.

859,019. ELECTRIC TRANSPORTATION SYSTEM; Franklin S. Smith, Philadelphia, Pa. App. filed March 11, 1907. Relates to modifications of the above.

859,029. ELECTRICAL APPARATUS; Joseph C. Vetter, Coney Island, N. Y. App. filed Aug. 24, 1905. Provides an induction apparatus particularly adapted for use with a cell to which it may be readily attached.

859,056. RAIL-BOND; Thomas C. Folsom, Tampa, Fla. App. filed Oct. 23, 1906. Consists in providing a rail-bond which shall be securely held in place in a protected position but which may be readily applied and removed when desired.

859,086. PROCESS OF MAKING PHOSPHORUS; Gilbert C. Landis, York, Pa. App. filed April 9, 1907. The process of making phosphorus which consists in reducing a compound in which phosphorus is present to fine granular form in which all of the material is of substantially the same size, and finally acting on the material by an electric furnace.

859,091. BATTERY-CELL; Arthur H. Marks, Akron, Ohio. App. filed Sept. 12, 1906. Relates to battery cells or boxes, and particularly to the covers of the same. Provides a cover the retaining flange of which is so constructed that it will not crack or break while in use. The top plate has a soft rubber flange around its edge extending over the sides of the box.

859,092. SPARK-GAP APPARATUS; Walter W. Massie, Providence, R. I. App. filed Jan. 16, 1906. The spark gap rods of a wireless transmitter have openings therein for the passage of a cooling medium and perforations leading from the openings for the escape of said cooling medium, in proximity to the gap between the rods.

859,132. SMELTING PROCESS; Frederick T. Snyder, Oak Park, Ill. App. filed June 11, 1906. The process of smelting ores containing zinc which consists in mixing the ore with reducing materials, heating the mixture to reduce and volatilize the zinc, condensing the gaseous zinc on the earthy portions of the ore, then smelting said earthy portions to form a slag, thereby revolatilizing the zinc, and condensing the revolatilized zinc.

859,133. SMELTING-FURNACE; Frederick T. Snyder, Oak Park, Ill. App. filed June 18, 1906. Relates to a furnace for carrying out the above-described process.

859,134. SMELTING PROCESS; Frederick T. Snyder, Oak Park, Ill. App. filed June 25, 1906. Relates to an additional process of treating ore.

859,135. METALLURGICAL PROCESS; Frederick T. Snyder, Oak Park, Ill. App. filed June 30, 1906. A still further process of treating zinc sulfid ore.

859,136. ELECTRIC FURNACE; Frederick T. Snyder, Oak Park, Ill. App. filed June 30, 1906. Relates to an electric furnace for carrying out the foregoing processes.

859,137. ELECTRIC FURNACE; Frederick T. Snyder, Oak Park, Ill. App. filed July 25, 1906. Another form of the furnace for smelting ores, particularly zinc ores.

859,143. METHOD OF GENERATING AND DISTRIBUTING ELECTRICAL ENERGY; William Stanley, Great Barrington, Mass. App. filed Jan. 20, 1904. Details of construction of three-phase generator.

859,147. AUTOMATIC ALARM DEVICE; Louis Strodtbeck, Middletown, Ohio. App. filed Jan. 18, 1907. Relates to improvements in automatic alarm devices and more particularly to one for use in gas pipes or mains for sending an alarm upon the stoppage of the gas or fluid therethrough.

859,163. CONTROLLING AND BRAKING DEVICE FOR ELECTRIC ELEVATORS; Parvin Wright, Los Angeles, Cal. App. filed Jan. 19, 1905. Relates to means for controlling the operation of electric elevators and particularly means for automatically arresting the movement of the elevator when it reaches the upper or lower limits of travel and means for automatically arresting the movement of the elevator on the occurrence of a slack cable due to the car or cage sticking in the shaft.

859,178. PROCESS OF TREATING LIQUORS BY ELECTRICITY; Christian H. C. Koch, Chicago, Ill. App. filed Sept. 5, 1902. The process of treating liquors which consists in applying to the cask or barrel in which the liquor is shipped, two electrodes, one at each end thereof, and then passing an electric current through said ends and through the said liquor without having anything other than the barrel or cask in contact with the liquor.

859,182. RAIL-SPREAD DETECTOR FOR RAILWAY-TRAINS; Joseph A. Shires, Denver, Col. App. filed Feb. 15, 1907. One of the wheel axles is made with a telescoping section and an electric alarm device is arranged to be actuated by the elongation of this axle.